

# **MES MAMPAD COLLEGE (AUTONOMOUS)**

**Affiliated to the UNIVERSITY OF CALICUT**

**Syllabus for Under Graduate Programme**

**in**

**B.Sc. Food Technology**

**(CBCSS- UG)**

**M E S Mampad College (Autonomous)**

**2021-22 Admission onwards**

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## **B.Sc. FOOD TECHNOLOGY DEGREE PROGRAMME-LRP (LANGUAGE REDUCED PATTERN)**

The B.Sc. Degree Programme means the entire course study and examinations for the award of degree. The duration of BSc Food Technology under graduate programme shall be of 6 semesters distributed over a period of 3 years. A sequence of 18 academic weeks with a unit of five working days constitute one semester. Course means a segment of subject matter to be covered in a semester (traditionally referred to as a paper). BSc Food Technology degree programme is a language reduced pattern has common courses of compulsory English and additional languages in 1<sup>st</sup> and 2<sup>nd</sup> semester which is taught by language teachers. Those are Common English course I, Common English course II, Common English course III, Common English course IV, Additional language course I and Additional language course II. It may be Hindi, Arabic or Malayalam. Additional language may be chosen by the students according to their wish. General Course I, II, III and IV are with a code of A which may be taught by either parent or Language Teachers depend upon their workload. Core courses in BSc Food Technology are 17 numbers with a code of B will be taught by parent department. Complimentary courses refer to course related to core course of BSc Food Technology degree programme which has Physics & Chemistry and are distributed in first four semesters. Food Science & Quality Control is chosen as complimentary course for BSc Chemistry degree programme with a code of C and finally open course which is taught to the students of other than B.Sc. Food Technology degree programme from parent department. There are 3 open courses, of which one course will be selected by student at his / her choice and will be studied in fifth semester with a code of D. Audit courses are mandatory for the completion of the programme but credits will not be counted for the calculation of SGPA or CGPA. There shall be one audit course in each first four semesters. Audit courses material may be getting from MOOC, Swayam or any other online platform and students can also attain these credits from any one of the above said online platform (which is optional). Audit course code is E. Audit courses examination will be conducted by college itself from the pool of questions which is supplied from University. The college should send the list of passed students to the university at least before the commencement of fifth semester examinations. List of courses in each semester with credits are given below

Sl.No.	Name of the course	Credits	Semester
1	Environment Studies	4	1
2	Disaster Management	4	2
3	Human Rights/Intellectual property Rights/Consumer Protection	4	3
4	Gender Studies/Gerontology	4	4

Credits means a unit of academic input measured in terms of weekly contact hours/course contents assigned to a course. Each course shall have certain credits. For passing the degree programme the student shall be required to achieve a minimum of 120 credits of which 38 credits

shall be from common courses (14 credits for common English courses, 8 credits for Additional language courses and 16 credits for General Courses.) 56 credits from core ,complimentary(24 credits) and 3 credits from open course. Students of BSc Food Technology should undergo a project work for a period of 30 days during 5<sup>th</sup> or 6<sup>th</sup> semester which is done as ‘In plant Training’.

### Credit Distribution of B.Sc. Food Technology Programme

Sem.	Common Course			General	Core Course						Complementary Course		Open Course	Total				
	English		Additional Language								I	II						
I	3	3	4			3						2	2		17			
II	4	4	4			3						2	2		19			
III				4	4	3	-						2	2		15		
IV				4	4	4	3						2+4	2+4		27		
V						3	4	3									3	14
VI						3	3	4	4	3	5	2	2				28	
Total	14 Credits (350 Marks)		8 Credits (200 Marks)	16 credits (400 Marks)		55 Credits (1375 Marks)						12 Credits (400 Marks)	12 credits (400 Marks)	3 Credits (75 Marks)	120			
	38 Credits (950 Marks)					82 Credits (2225 Marks)										<b>120</b>		
												<b>Total Marks</b>	<b>3200</b>					

#### Mark distribution

Common: English	2x100 2x75	350	550
Additional: Mal/Hindi.....	2x100	200	
General	4x100	400	400
Core(including project)	9 x 75 6 x 100	675 700	1375
Open course	1x75	75	75
Complementary I & II	4X75X2 1x100x2	600 200	800
<b>Total marks</b>			<b>3200</b>

## Examinations

There shall be Examinations at the end of each semesters. A student shall be permitted to appear for the semester examination, only if he or she secures not less than 75% attendance in each semester. Practical Examination shall be conducted at the end of 4<sup>th</sup> & 6<sup>th</sup> semesters

## Evaluation and Grading

Mark system is followed instead of direct grading for each question. After external and internal evaluations marks are entered in the answer scripts. All other calculations, including grading, will be done by the university using the software. Indirect Grading System in 10 point scale is followed. Each course is evaluated by assigning marks with a letter grade (O, A+, A, B+, B, C, P, F, I & Ab) to that course by the method of indirect grading.

### Ten Point Indirect Grading System

% of Marks (Both Internal & external put together)	Grade	Interpretation	Grade Point Average	Range of Grade points	Class
95 and above	O	Outstanding	10	9.5 - 10	First Class with distinction
85 to below 95	A <sup>+</sup>	Excellent	9	8.5 - 9.49	
75 to below 85	A	Very good	8	7.5 – 8.49	
65 to below 75	B <sup>+</sup>	Good	7	6.5 – 7.49	First Class
55 to below 65	B	Satisfactory	6	5.5 – 6.49	
45 to below 55	C	Average	5	4.5 – 5.49	Second Class
35 to below 45	P	Pass	4	3.5 – 4.49	Third class
Below 35	F	Failure	0	0	Fail
Incomplete	I	Incomplete	0	0	Fail
Absent	Ab	Absent	0	0	Fail

### Course Evaluation

The evaluation Scheme for each course shall contain two parts. They are

- 1) External Evaluation
- 2) Internal Evaluation

### External Evaluation

External evaluation carries 80% marks. Examinations will be conducted at the end of each semester. The external question papers may be of uniform pattern with 80/60 marks the courses with 2/3 credits will have an external examination of 2 hour duration of 60 marks and courses with 4/5 credits will have an external examination of 2.5 hours duration of 80 marks.

**Theory Question Paper pattern (for 60 marks/1 to 3 Credits)**

Duration	Pattern	No. of Questions	Marks	Ceiling of Marks
2 Hours	Shortanswer	12	2	20
	Paragraph	7	5	30
	Essay	2	1x10	10
<b>Total Marks</b>				60

**Theory Question Paper pattern (for 80 marks/4 to 5 Credits)**

Duration	Pattern	No. of Questions	Marks	Ceiling of Marks
2.5 Hours	Shortanswer	15	2	25
	Paragraph	8	5	35
	Essay	4	2x10	20
<b>Total Marks</b>				80

**Practical Examination**

The external examination in practical courses shall be conducted examiner appointed by the CE. Food Processing & Preservation (FTL 3 B 06 P), Food Chemistry & Analytical Instrumentation (FTL 4 B 08 P) courses practical examination will be combined, the course code stands FTL 4 B 08 P (Credits 3) and conducted at the end of Second year, similarly Cereals, Pulses and Oilseeds Technology (FTL 5 B 12 P) and Technology of Fruit, Vegetables, Spices & Plantation crops (FTL 6 B 19 P) courses practical examination will be combined, the course code stands FTL 6 B 19 P (Credits 5), Technology of Animal Foods FTL 6 B 20 P (Credits 5) and Analysis of Foods FTL 5 B 14P (Credits 2) will be conducted at the end of 6<sup>th</sup> semester including Project work / In Plant training evaluation (Credit 2).

**Practical Exam Pattern (Core & Complementary of 4-5 credits)**

Record	Procedure	Work done	Spot test	Viva-voce	Total
5	5	20x2	20	10	80

**Practical Exam Pattern (Core & Complementary of 1-3 credits)**

Record	Procedure	Work done	Spot test	Viva-voce	Total
5	5	15x2	10	10	60

**Internal Evaluation**

Internal evaluation will be of 20% in each course. The college has to send the marks obtained by the students in internal exam to the CE by head of department of the college. Internal assessment marks should be published in the department notice board. A grievance committee is constituted at department level to look in to the matter of any discrepancy. The internal assessment shall be based on a pre-determined transparent system involving written test,

assignments, seminars and attendance in respect of theory course and on tests/records/viva-voce/attendance in respect of practical course. Internal evaluation for project shall be based on content and Method of presentation.

**Distribution of Marks for Theory (Core& Complimentary) 4 to 5 credits (Max Internal 20)**

Attendance		Test paper		Seminar/Assignment/Viva	
85% and above	4 marks	85%-100	8 marks	Outstanding	8 marks
75- <85%	2 marks	65 to 85%	6 marks	Excellent	7 marks
50- < 75%	1 marks	55 to 65%	4 marks	Very good	6 marks
		45 to 55%	3.0 marks	Good	5 marks
		35 to 45%	2 marks	Average	4 mark
		Less than 35	1 Marks	Poor	1 Mark
<b>Maximum</b>	<b>4 marks</b>	<b>Maximum</b>	<b>8 marks</b>	<b>Maximum</b>	<b>8 marks</b>

**Internal Test Papers - 60marks Pattern**

Duration	Pattern	No. of Questions	Marks	Ceiling of Marks
2 hrs	Short answer	6	5x2	<b>10</b>
	Paragraph	4	2x5	<b>10</b>
	Essay	2	1x10	<b>10</b>
Total Marks				<b>30</b>

**Distribution of Marks for Theory (Core&Complimentary) 1 to 3 credits (Max Internal 15)**

Attendance		Test paper		Seminar/Assignment/Viva	
85% and above	3 marks	85%-100	6 marks	Outstanding	6 marks
75- <85%	2 marks	65 to 85%	5 marks	Excellent	5 marks
50- < 75%	1 marks	55 to 65%	4 marks	Very good	4 marks
		45 to 55%	3.0 marks	Good	3 marks
		35 to 45%	2 marks	Average	2 mark

	Less than 35	1 Marks	Poor	1 Mark	
<b>Maximum</b>	<b>3 marks</b>	<b>Maximum</b>	<b>6 marks</b>	<b>Maximum</b>	<b>6 marks</b>

### Internal Test Papers -80 marks pattern

Duration	Pattern	Total number of questions	Marks for each question	Ceiling of Marks
1 Hr	Short answer	6	5x2	10
	Paragraph	4	4x5	20
	Essay	2	1x10	10
Total Marks				40

### Distribution of Marks for Practical (Core&Complimentary 4-5 credits)

Components	Maximum 20 Marks
Attendance	5
Lab performance	5
Viva-voce	10

### Distribution of Marks for Practical (Core & Complimentary, 1-3 credits )

Components	Maximum 15 Marks	Project 3marks	In plant Training 8 marks	Industry visit 4Marks
Attendance	5	Submission -3	Presentation 8	First year 1Mark Second year 1 mark Third year - 2 marks
Lab performance	2.5			
Viva-voce	7.5	<b>Total for Project, Training and I.V. 15 marks</b>		

### Project work / in plant training

Students of B.Sc. Food Technology should undergo a project/ in plant training work for a period of 30 days during Fifth or Sixth Semester. The purpose of the programme is to get hands-on experience on various aspects of food industries that form the strong foundation for the young food technologists. Each student should undergo a project work and prepare a project report under guidance of Faculty in department. Students those who complete project work satisfactory will only be eligible for doing training. On completion



of in plant training report duly certified by the supervisor in the industry, a seminar should be conducted in the department. The bonafide project report and training report should be submitted to the department. The Reports will be evaluated by the external examiner and a viva voce will be conducted.

### BSc Food Technology – Core Course structure, works load and credit distribution

Course Code	Instructional Hours per week		Credits	Marks				Total
	Theory	Practical		Theory		Practical		
FTL 1 B 01 FTL 1 B 02 P	1	2	1+2=3	60	15	-	-	75
FTL 2 B 03 FTL 2 B 04 P	1	2	1+2=3	60	15	-	-	75
A11	4	-	4	80	20			100
A12	4	-	4	80	20			100
FTL 3 B 05 FTL 3 B 06 P	3	4	3	60	15	-	-	75
A13	4	-	4	80	20			
A14	4	-	4	80	20			100
FTL 4 B 07	3	-	4	80	20	-	-	100
FTL 4 B 08 P	-	4	3	-	-	60	15	75
FTL 5 B 09	3	-	3	60	15	-	-	75
FTL 5 B 10	5	-	4	80	20	-	-	100
FTL 5 B 11	5	-	3	60	15	-	-	75
FTL 5 B 12 P	-	4	3	-	-	-	-	-
FTL 5 B 13 P	-	3	-	-	-	-	-	-
FTL 5 B 14 P	-	3	2	60	15	-	-	75
FTL 5 D 01 / 02 / 03	2	-	3	60	15	-	-	75
FTL 6 B 15E1	4	-	3	60	15	-	-	75
FTL 6 B 15E2	4		3	60	15			75
FTL 6B 15E3	4		3	60	15			75
FTL 6 B 16	3	-	4	80	20	-	-	100
FTL 6 B 17	4	-	4	80	20	-	-	100
FTL 6 B 18	4		4	80	20			100
FTL 6 B 19 P	-	4	3+2=5	-	-	80	20	100
FTL 6 B 20 P		4	5			80	20	100

FTL 6 B 21 Pr	-	2	2	-	-	60	15	75
<b>Total</b>	-	-	<b>78</b>	<b>1200</b>	<b>300</b>	<b>280</b>	<b>70</b>	<b>1850</b>

**Semester I**

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Course code	Title of course	Hours per week	No. of credits	Hours
A02	English Language II	5	3	17
A07	Second Language	5	4	
FTL 1 B 01	Perspectives of Food Science & Technology	1+2(P)	2+1=3	
	Complementary Physics(T) I	2	2	
	Complementary Practical	2	-	
	Complementary chemistry(T) I	2	2	
	Complementary Practical	2	-	

### Semester II

Course code	Title of course	Hours per week	No. of credits	Total credits
A03	English Language	4	4	19
A04	English Language	5	4	
A08	Second Language II	5	4	
FTL 2 B 03	Food Microbiology I	1+2(P)	1+2=3	
	Complementary Physics(T) II	2	2	
	Complementary Practical	2	-	
	Complementary chemistry(T) I	2	2	
	Complementary Practical <sup>11</sup>	2	-	

### Semester III

Course code	Title of course	Hours per week	No. of credits	Total credits
A11	Common General Course I	4	4	15
A12	Common General Course II	4	4	
FTL 3 B 05	Food Engineering	3	3	
FTL 3 B 06 (P)	Food Processing & Preservation	4	-	
-	Complementary Physics(T)III	3	2	
	Complementary Practical	2	-	
	Complementary chemistry(T) III	3	2	
	Complementary Practical	2	-	

### Semester IV

Course code	Title of course	Hours per week	No. of credits	Total credits
A13	Common General Course III	4	4	27
A14	Common General Course IV	4	4	
FTL 4 B 07	Food Chemistry & Analytical Instrumentation	3	4	
FTL 4 B 08 P	Food Chemistry & Analytical Instrumentation	4	3	
	Complementary Physics(T) IV	3	2	
	Complementary Practical	2	4	
	Complementary chemistry(T) IV	3	2	
	Complementary Practical	2	4	

### Semester V

Course code	Title of course	Hours per week	No. of credits	Total credits
FTL 5 B 09	Food Microbiology II	3	3	15
FTL 5 B 10	Cereals, Pulses and Oil seeds Technology	5	4	
FTL 5 B 11	Food Preservation & Packaging Technology	5	3	
FTL 5 B 12 P	Cereals, Pulses and Oil seeds Technology	4	-	
FTL 5 B 13 P	Food Microbiology II	3	-	
FTL 5 B 14 P	Analysis of foods	3	2*	
FTL 5 D 01 / 02 / 03	01. Technology of Spices 02. Fruits and Vegetables Processing 03. Food & Health	2	3	

### Semester VI

Course code	Title of course	Hours per week	No. of credits	Total credits
FTL 6 B 15 E	Dairy Technology	4	3	27
FTL 6 B 16	Technology of Animal Food	3	4	
FTL 6 B 17	Food safety, Food laws & regulations	4	4	
FTL 6 B 18	Technology of Fruits ,Vegetables, Spices & Plantation Crops	4	4	
FTL 6 B 19 P	Technology of Fruits ,Vegetables, Spices & Plantation Crops	4	3+2=5	
FTL 6 B 20 P	Technology of Animal Foods	4	5	
FTL 6 B 21Pr	Project work	2	2	
	13			

# B.Sc. FOOD TECHNOLOGY

## FTL 1 B 01 PERSPECTIVES OF FOOD SCIENCE & TECHNOLOGY (1+2=3 Credits)

### Objectives

To build up a strong base in Food science & Technology by providing knowledge in food composition, food quality assessment and nutritional facts of different foods. Knowledge on major research institutions, journals and industries related to the field.

### Learning Outcomes

After this course students will get

- The basic knowledge of food science and technology.
- Structure and composition of different types of foods.
- Basics of quality assessment, nutritional factors and health foods.
- Knowledge in Food additives (Preservatives, colours, improvers etc).
- An idea about journals, research centers and leading industries.

SI No:	Topic	Course outline	Hrs
1	<b>Introduction</b>	Scope of food science and Technology. Functions of food. Nutrients, Water, Carbohydrates, Proteins, Lipids, Vitamins and Minerals.	2
2	<b>Composition and nutritive value</b>	Pulses & Legumes, Nuts & Oilseeds, Meat, Fish, Egg and Milk Structure and composition of wheat and Rice. Classification and Composition of Fruits, Vegetables and Spices.	3

3	<b>Food Quality Assessment</b>	Sensory assessment-Appearance of food- visual perception, colour of foods, smell, flavour and taste.Hidden Characteristics—Nutritional value and toxicity. Quantitative Characteristics—Crop yield and finished product yield.  Threshold tests, difference tests, ranking test & hedonic scale	3
4	<b>Food Additives</b>	Preervatives, Coloring agents, Flavour and Flavour enhancer, Anti-oxidants, Artificial sweeteners,Stabilizers, Thickening agents, Anticaking agents, Bleaching and Maturing agents, Flour improvers, Leavening agents, Surface active agents.	2
5	<b>Health foods</b>	Functional Foods, Prebiotics, Probiotics, Nutraceuticals. Organic Foods, GM Foods and their Advantages and Disadvantages	1
6	<b>Food Allergy</b>	Common Symptoms of Food Allergy. Major group of Food Allergens	1
7	<b>Food Processing</b>	Various sectors in Food Processing. . Significance of food processing in national development. Ministry of Food Processing Industries.	2
8	<b>New Product Development</b>	New Food product needs, Consumer Preference and Market Survey, Steps in New Product Development.	1
9	<b>Food Safety</b>	Need for Food Safety. Hazards in Foods. Physical, Chemical and Biological	1

## References

1&2 Introduction, Composition and nutritive value	<ul style="list-style-type: none"> <li>• S. Manany, N S. Swamy Food Facts and Principles. New Age International Publishers.</li> <li>• Potter NN, Hotchkiss JH. Food Science. CBS publishers and distributors</li> </ul> <p>Sumati R Mudambi , Rajagopal M V. Fundamentals of Food and Nutrition. New Age international publishers.</p>
3. Food quality assessment.	<ul style="list-style-type: none"> <li>• Potter NN , Hotchkiss JH. Food Science. CBS publishers and distributors</li> <li>• S. Manay, N S. Swamy Food Facts and Principles. New Age International Publishers</li> </ul>
4. Food additives.	<ul style="list-style-type: none"> <li>• S. Manany, N S. Swamy Food Facts and Principles. New Age International Publishers.</li> <li>• Murano, Peter S. Understanding Food Science and Technology.</li> </ul>
5. Health foods.	<ul style="list-style-type: none"> <li>• Sumati R Mudambi , Rajagopal M V. Fundamentals of Food and Nutrition. New Age International Publishers</li> <li>• Shubhangini A Joshi. Nutrition and Dietics. Tata McGraw Hill Education Private limited.</li> </ul>
6. Food Allergy	Shubhangini A Joshi. Nutrition and Dietics. Tata McGraw Hill Education Private limited
7. Food Processing	Website of ministry of food processing Industries, Govt of India and annual reports
8. Product Development	Fadi Aramouni, Ph.D. Kathryn Deschenes, M.S Methods For Developing New Food Products An Instructional Guide
9. Food Safety	Food safety manuals-Food Safety Authority of India



## FTL 1 B 02 P PERSPECTIVES OF FOOD SCIENCE AND TECHNOLOGY

### Objectives

- To learn the basic qualitative tests for Biomolecules
- To develop skills in basic food analysis experiments

### Learning Outcomes

On completion of the course, students are able to

- Understand preparation and standardization of reagents
- Skill for qualitative analysis of Carbohydrate and Protein
- Develop skill to s perform practical determinations of Moisture, acidity and TSS of foods

SI No:	Practicals
1	Standardization of NaOH.
2	Standardization of HCl
3	Determination of Moisture using a) Hot air oven b) Distillation method c). Infrared method
4	Determination of Acidity & Ph
5	Determination of T S S
6	Qualitative test for carbohydrates – Molisch’s test, Benedict’s test, Iodine test, Anthrone test, Selivanoff’s test.
7	Qualitative Test of Proteins
8	Practical Demonstration- Pilot / Industrial scale Food Production / Processing
9	<b>Industrial Visit I: Food Processing Unit.</b>

## FTL 2 B 03 FOOD MICROBIOLOGY – I (1+2=3 Credits)

### Objectives

Microbiology is an applied science, helping agriculture, health, and medicine and maintenance of the environment. Micro organisms are extremely important in our everyday lives. This course focuses on the general principles of microbiology and includes the following topics: history of microbiology, microscopy and microbial cell structure.

### Learning Outcomes

After successful completion of this course, students are expected to be able to:

- The student will have knowledge on history of microbiology.
- Understand concept of growth and reproduction of bacteria, relevance of microscopy.
- Understand the basic microbial structure, function and study the comparative characteristics of prokaryotes and eukaryotes and understand the structural similarities and differences among them.

SI NO:	Topic	Course outline	Hrs
1	Evolution	History of Microbiology-Prokaryotes and Eucaryotes, Theory of Spontaneous Generation, Germ Theory of Disease, Koch's Postulates, Pure culture concept.	2
2	Microscopy	Parts of microscope, Resolving power, Limits of resolution, Refractive index, Magnification. Light Microscope –Bright field, Dark field. Electron Microscope –Transmission electron microscope, Scanning electron microscope.	3
3		Micro Organisms	
	a) Bacteria	Structure, Morphology, Staining -Simple, Gram and Negative. Important genera of Bacteria -Bacillus, Clostridium, Lactobacillus, Leuconostoc. Physical conditions required for growth, Growth curve. Reproduction -Binary fission, Transformation, Transduction and conjugation. Nutritional requirements-Phototrophs, Chemotrophs, Autotrophs, Heterotrophs.	5
	b) Fungi	Structure Morphology, Classification, Reproduction –Sexual and Asexual. Moulds of Industrial importance Rhizopus, Aspergillus, and Penicillium.	2

	c)Yeasts	Structure, Morphology, Reproduction –Budding Reproduction –Sexual and Asexual. Yeast of Industrial Importance-Saccharomyces cerevisiae.	2
	d) Virus	Classification, Composition, Morphology, Replication of virus	2

### References

1.Evolution	<ul style="list-style-type: none"> <li>Bibek Ray &amp; Arun Bhuniya , 2007.Fundamental Food Microbiology. CRC Press</li> </ul>
2.Microscopy	<ul style="list-style-type: none"> <li>Suzanne Bell &amp; Keith Morris, 2009. An Introduction to Microscopy. CRC Press.</li> <li>Elizabeth M. Slayter&amp; Henry S. Slayter, 2000. Light and Electron Microscopy. Cambridge University Press.</li> </ul>
3.Bacteria, Fungi Yeasts and Virus	<ul style="list-style-type: none"> <li>Ananth Narayanan R Jayaram Paniker CK, 2009. Text book of Microbiology. University Press Pvt Ltd, Hyderabad</li> <li>Prescott, L.M, Harley, J.P &amp; Klein D.A, Microbiology. MC Graw Hill, New York.</li> <li>Frazier J &amp; Westhoff DC, 20148. Food Microbiology. MC Graw Hill, New York.</li> <li>Pelczar J M &amp; Reid R D. Microbiology. Tata MC Graw Hill.</li> <li>Black JG. Microbiology, Principles and Explorations John Wiley</li> </ul>

### FTL 2B 04 P FOOD MICROBIOLOGY –I

#### Objectives

- To learn the names and uses of different types of microbiology equipment's & glasswares.
- To develop skills in microbiological laboratory techniques.

#### Learning Outcomes

On completion of the course, students are able to

- Understand various accessories for microbiology practical ,
- Develop skill to stain bacterial cell

SI No:	Practicals
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1	Introduction to equipment's and glassware used in
2	microbiology Sterilization techniques: Dry heat and moist heat
3	Staining reagents and procedures
4	Staining techniques – simple staining, gram staining, negative staining.
5	Fungal staining

### References

<ul style="list-style-type: none"> <li>• Harrigan.F.W, 2013. Laboratory Methods in Food Microbiology</li> <li>• James Cappuccino. Microbiology A Laboratory Manual. Pearson</li> </ul>
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### FTL 3B 05 FOOD ENGINEERING (3 Credits)

#### Objectives

This course is designed to teach students the fundamentals of food engineering. Students will acquire knowledge of food engineering principles in food processing such as heat and mass transfer operations, refrigeration and various unit operations. This will help to understand the concepts of equipment of refrigeration, freezing, thermal processing, drying, and other food operations.

#### Learning Outcomes

By the end of the course, the student should be able to:

- Identify the mechanisms by which various unit operations in food processing optimize Food quality and extend shelf life of foods
- Understand principles of heat and mass transfer phenomena
- Describe the theories of refrigeration and freezing
- Understand rheological characteristics of foods
- Understand the working principle of heat exchangers, evaporators, driers and boilers

SI No:	Topic	Course outline	Hrs
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1	<b>Engineering Properties of Food Materials</b>	Physical property – Size, Shape, Density, Specific Gravity, Angle of repose. Mechanical Properties. Specific Heat, Thermal conductivity. Rheological Properties- Viscosity, Apparent viscosity- Newtonian and Non-Newtonian.	5
2	<b>Unit of operations in Food Engineering</b>	Basic Principle, Types and Applications: Blanching, Evaporation, Drying, Freezing & Chilling. Frying -Types, Effect of heat on Fried Foods. Extrusion-Classification-Single Screw and Twin Screw Extruder, Parts, Mechanism of Working, Applications	5
3	<b>Refrigeration &amp; Freezing</b>	Refrigeration- Principle of refrigeration, Vapour compression refrigeration cycle. Freezing. Principle of freezing & freezing rate. Types of freezers- Air blast, Contact, Immersion, Fluidized bed and Cryogenic freezers	6
4	<b>Evaporation</b>	Principle, Single effect and Multiple effect Evaporator. Types of Feeding Mechanism. Types of Evaporators - Horizontal Tube, Vertical tube, Falling film Evaporator, Rising film Evaporator.	6
5	<b>Driers</b>	Driers Principle, Constant rate & Falling rate of period of drying. Types of Driers - Drum Drier, Cabinet Drier, Tunnel Drier, Spray Drier, Fluidized bed Drier, Freeze Drier.	6

6	<b>Heat Transfer</b>	Mode of Heat Transfer– Conduction, Convection, Radiation.	
7	<b>Heat Exchanger</b>	Classification, Contact type Heat Exchange - Non-contact type heat exchanger, Plate Heat Exchanger, Scraped Surface Heat exchanger, Tubular Heat Exchanger, Double & Triple Tube Heat Exchanger, Shell & Tube Heat Exchanger. <b>Pasteurization:Types-LTLT,HTST, UHT.</b> Different methods of Pasteurization and Devices	10
8	<b>Boilers</b>	Boiler- Principle, Classification of Boilers, Working of Boiler. Water tube & Fire tube boilers	5

## References

1.unit operations and heat transfer	<ul style="list-style-type: none"> <li>• Rao D G. Fundamentals of Food Engineering. PHI learning private limited</li> <li>• Sahay K M&amp;singh kk,1994. Unit operations of Agricultural processing Vikas Publishing House</li> </ul>
2.Heat exchanger	<ul style="list-style-type: none"> <li>• Singh R P, Heldman DR1993 Introduction to Food Engineering Academic press</li> <li>• Romeo. Toledo T fundamentals Food Process Engineering CBS Publishers</li> <li>• Rao D G. Fundamentals of Food Engineering. PHI learning private limited</li> <li>• Charm SE, Macabe, W L smith J C &amp;Harriot P 1993. Unit operations of Chemical Engineering. McGraw Hills</li> </ul>
3.Refrigeration and freezing	<ul style="list-style-type: none"> <li>• R S Khurmi&amp; J k Gupta, A Textbook of Refrigeration &amp; Air conditioning, S Chand</li> <li>• Rao D G. Fundamentals of Food Engineering. PHI learning private limited</li> </ul>
4.Evaporation	<ul style="list-style-type: none"> <li>• Charm SE, Macabe, W L smith J C &amp;Harriot P 1993. Unit operations of Chemical Engineering.</li> </ul>

	<p>McGraw Hills.</p> <ul style="list-style-type: none"> <li>• Rao D G. Fundamentals of Food Engineering. PHI learning private limited</li> <li>• Sahay K M&amp; Singh kk,1994. Unit operations of Agricultural processing Vikas Publishing House</li> </ul>
5.Driers and Boilers	<ul style="list-style-type: none"> <li>• Rao D G. Fundamentals of Food Engineering. PHI learning private limited</li> <li>• Sahay K M&amp;Singh kk,1994. Unit operations of Agricultural processing Vikas Publishing House</li> <li>• R S Khurmi i&amp; J k Gupta, A Textbook of Thermal engineering, S Chand</li> </ul>
6.Rheology	<ul style="list-style-type: none"> <li>• Rao D G. Fundamentals of Food Engineering. PHI learning private limited</li> <li>• Sahay K M&amp; Singh kk,1994. Unit operations of Agricultural processing Vikas Publishing House</li> </ul>

### FTL 3 B 06 P FOOD PROCESSING & PRESERVATION

SI No:	Practicals
1	Blanching of Vegetables.
2	Dehydration of Vegetables using Cabinet drier.
3	Determination of Moisture content
4	Dehydration of fruits in sugar syrup
5	Qualitative Determination of Benzoic acid & SO <sub>2</sub>
6	Sensory Evaluation
7	<b>Industrial Visit II: Well established Food Processing Unit</b>

### FTL 4 B 07 FOOD CHEMISTRY & ANALYTICAL INSTRUMENTATION

(4 Credits)

#### Objectives

- To provide basic knowledge of structure, composition, chemical reaction & classification

- To know importance and properties of minor nutrients.
- To familiarise the principles and working of Instruments for food analysis

### Learning Outcomes

- Exposure to various Instrumental analysis of foods which needed for statutory requirements
- Understand the constituents of foods which are always amenable during processing.
- Knowledge of minor constituents useful to get organoleptic character of foods.

SI No:	Topic	Course outline	Hrs
1	<b>Carbohydrates</b>	Classification, Properties and Reactions of 1) Monosaccharides-: Glucose & Fructose 2) Oligosaccharides: Maltose, lactose. Sucrose-Crystallization and Inversion. 3) Polysaccharides: Starch, Components of starch, Gelatinization, Retrogradation, Modified starch. Cellulose, Hemicellulose, Pectic substances, Gums, Dietary fiber	8
2	<b>Proteins</b>	Introduction to Food Protein, Structure of protein, Classification of proteins- Based on Structure, Biological function, Solubility.  Chemical properties-Hydrolysis, oxidation, Denaturation, protein determination-kjheldhals Method  Functional properties- Hydration, Viscoelastic-gluten, Precipitation -casein, Emulsifying -Egg.  <b>Amino acids</b> - classification-Based on structure, Nutritional requirement.  Physical properties-Isoelectric point, Zwitterion, Chemical properties -Reactions of Carboxyl, Amino group, Peptide bond formation, Colour reactions.	6



3	<b>Lipids</b>	<p>Classification-Simple,Compound,Derived, Number of carbon atoms.</p> <p>Physical properties- Polymorphism, Melting point, Tempering, Viscosity Specific gravity.</p> <p>Chemical properties -Hydrolysis,Saponification value, Iodine value,Hydrogenation,RMvalue,Polenske value Fatty acids-Saturated, Unsaturated, Polyunsaturated Fatty acids, Chemical properties, Rancidity, Antioxidants.</p>	6
4	<b>Water</b>	Introduction, Physical & Chemical properties of water, Moisture in Foods, Methods of Moisture Determination, Hydrogen bonding, Free & Bound water	6
5	<b>Pigments</b>	Properties and Occurrence: Chlorophyll, Carotenoids, Flavonoids, Anthocyanins, Anthoxanthins, Myoglobin.	6
6	<b>Browning</b>	Classification- Enzymatic browning Non enzymatic browning- Prevention and control-Maillard reaction and Caramelisation	4
7	<b>Enzymes</b>	Introduction, Definition, Occurrence, Classification. Properties of Enzymes- Specificity, Factors affecting enzyme activity. Enzymes in food Industry.	6
8	<b>Colloids</b>	Colloidal chemistry, Properties of solutions, Sols & Suspensions, Food colloids.	4
9	<b>Emulsions</b>	Emulsion, Types, Emulsifying Agents	2
	<b>Instrumentation</b>		
10	<b>Colorimetry</b>	Principles, Beer – Lambert's Law, Techniques and Instrumentation. Fluorimetry.	6

11	<b>Spectrophotometry</b>	Principles, Parts of Spectrophotometers. Atomic Absorption Spectrophotometry	
12	<b>Chromatography</b>	Classification, Principle and Application- Adsorption, Partition, Ion Exchange Chromatography. Paper, Column, Thin layer, Gas Chromatography, High Performance Liquid Chromatography. GCMS	8

### References

1,2,3 Carbohydrates Proteins, Lipids.	<ul style="list-style-type: none"> <li>• Ranganna S 2001. Hand book of analysis and quality control of fruits and vegetable products Tata-McGraw- Hill.</li> <li>• Meyer, L.H 1987 Food Chemistry CBS publishers.</li> <li>• Belitz, H.D 1999 Food Chemistry Springer Verlag</li> <li>• Fennema, O.R. 1996 Food Chemistry Marcel Dekker</li> </ul>
4.,5, 6 Water, Pigments, Enzymes	<ul style="list-style-type: none"> <li>• S. Manany, N S. Swamy Food Facts and Principles. New Age International Publishers</li> <li>• Meyer, L.H 1987 Food Chemistry CBS publishers</li> <li>• Ranganna S 2001. Hand book of analysis and quality control of fruits and vegetable products Tata-McGraw- Hill</li> </ul>
7.,8 Colloids, Emulsions	<ul style="list-style-type: none"> <li>• Wong, Dominic W.S Mechanism and Theory in Food Chemistry. CBS publishers</li> </ul>
9.,10 Colorimetry, Spectrophotometry	<ul style="list-style-type: none"> <li>• Sharma B.K. 2004, Instrumental Methods of Chemical Analysis. Goel Publishing House, New Delhi.</li> <li>• Nielson S 1994 Introduction to Chemical Analysis of Foods Jones &amp; Bartlett</li> <li>• Pomrenz Y &amp; Meloan CE 1996 Food Analysis Theory and Practice CBS</li> </ul>
11. Chromatography	<ul style="list-style-type: none"> <li>• Sharma B.K. 2004, Instrumental Methods of Chemical Analysis. Goel Publishing House, New Delhi.</li> <li>• Pomrenz Y &amp; Meloan CE 1996 Food Analysis Theory and Practice CBS</li> </ul>

**FTL 4 B 08 P FOOD CHEMISTRY & ANALYTICAL INSTRUMENTATION**  
(3 Credits)

**Objectives**

- To provide basic knowledge of structure, composition, chemical reaction & classification
- To know importance and properties of minor nutrients.
- To familiarise the principles and working of Instruments for food analysis

**Learning Outcomes**

- Exposure to various Instrumental analysis of foods which needed for statutory requirements
- Understand the constituents of foods which are always amenable during processing.  
Knowledge of minor constituents useful to get organoleptic character of foods

SI No:	Practicals
1	<b>Chemical Analysis of Lipids</b> a) Determination of Iodine value b) Determination of Saponification value c) Determination of peroxide value d) Determination of Free Fatty Acid
2	<b>Analysis of Protein</b> Kdheleahl's methods
3	<b>Analysis of Water</b> Total solids, Acidity of water, Alkalinity of water, Determination of Chloride, Hardness of water.
4	Paper chromatography
5	Ash content
6	Test for adulteration-Milk, Ghee, Pepper, Honey, Coconut Oil, Tea and Spices

## Reference

- Nielson S 1994 Introduction to Chemical Analysis of Foods Jones & Bartlett
- Ranganna S 2001. Hand book of analysis and quality control of fruits and vegetable products Tata- McGraw- Hill.

## FTL 5 B 09 FOOD MICROBIOLOGY II (3 Credits)

### Objective

Students will acquire knowledge on techniques for the isolation epidemiology of food borne, and spoilage of microorganism, the microbiology of water , milk , fermented foods

### Learning Outcome

- Understand microbiological techniques for the isolation of pure culture of Micro organisms.
- To understand spoilage organisms, growth factors and control.
- To know the effect of fermentation in food production and how it influence the Microbiological quality and status of food product.
- To perform and analyze the microbiological safety of milk and water

SI No:	Topic	Course outline	Hrs
1	<b>Culture Media</b>	Bacteriological Media – Selective, Differential, Enrichment Media.	5
2	<b>Methods of Isolating Pure Culture</b>	Serial Dilution, Pour plate, Streak plate, Stroke Culture. Anaerobic Culture Methods.	5
3	<b>Control of Microorganism</b>	Physical Agents –Sunlight, Drying, Dry heat, Moist heat, Radiation, Filtration, Ultrasonic and Sonic Vibrations. Chemical Agents-Characteristics of an Ideal Antimicrobial Chemical Agent, Alcohols, Aldehydes, Dyes, Halogens, Phenols, Alkali, Gases.	6

4	<b>Food Spoilage</b>	<b>Food Spoilage:</b> Effect of environmental conditions, physical properties of food, factors affecting growth of microorganism Sources of contamination, factors responsible for spoilage, factors affecting kinds and number of microorganisms in food. Chemical changes due to spoilage.	8
5	<b>Effect of Spoilage</b>	Contamination and Spoilage of Fruits and Vegetables, Meat & Meat products, Milk & Cream, Cereal & Cereal products, Spoilage of Canned Foods.	8
6	<b>Microbial Intoxications &amp; Infections</b>	Definition, Exotoxin, Endotoxin, Intoxications and Infections – sources, symptoms Salmonella, E.coli, B.cereus, Staphylococcus, Clostridium, Shigellosis, Vibrio cholerae. Methods of Prevention and investigation of food borne disease outbreak. Mycotoxins, Significance of Aflatoxin. Patulin, Ochratoxins, Infectious Hepatitis	7
7	<b>Microbes in Fermented Foods</b>	Fermentation – Homo and heterofermentation, Fermented vegetable products, Sauer Kraut, pickles, soy sauces, idly. Fermented dairy products – Cheese, yoghurt.	5
8	<b>Water &amp; Milk Testing</b>	<b>Microbiological testing of water</b> Microbial flora of natural water, polluted and potable water, Coliform bacteria, indicator organism Slime forming bacteria, Iron bacteria Enumeration of E. coli, SPC.  <b>Microbiology of milk-</b> Pasteurization of milk, Phosphatase test, Microbiological examination of milk -Standard Plate Count, Direct microscopic	4

	count, Methylene Blue Reduction test.	
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## References

1&2. Culture Media, Methods of isolating Pure culture,	<ul style="list-style-type: none"> <li>• Ban wartGJ ,1989. Basic Food Microbiology. AVI publishers</li> <li>• Ananthanarayanan R JayaramCK 2009 Text book of microbiology. University</li> <li>• Prescott, L.M, Harley, J.P and Klein, D.A Microbiology. McGraw Hill New York</li> </ul>
3 ,4., 5,&6 Control of M.O Foodspoilage, Effectof spoilage, Microbial intoxications& Infections	<ul style="list-style-type: none"> <li>• Black, JG. Microbiology. Principles and Explorations John Wiley</li> <li>• BanwartGJ ,1989. Basic Food Microbiology. AVI publishers</li> <li>• Jay JM, Loessner MJ &amp; Golden D A 2005. Modern Food Microbiology. Springer Verlag</li> <li>• Prescott, L.M, Harley, J.P and Klein, D.A Microbiology. McGraw Hill New York</li> <li>• Frazier &amp; Westhoff DC. 2014. Food Microbiology. McGraw Hill, New York.</li> </ul>
7. Microbes in fermented foods	<ul style="list-style-type: none"> <li>• BanwartGJ ,1989. Basic Food Microbiology. AVI publishers</li> <li>• Prescott, L.M, Harley, J.P and Klein, D.A Microbiology. McGraw Hill New York</li> <li>• Frazier &amp; Westhoff DC. 2014. Food Microbiology. McGraw Hill, New York.</li> </ul>
8. Water & Milk testing	<ul style="list-style-type: none"> <li>• Frazier &amp; Westhoff DC. 2014. Food Microbiology. McGraw Hill, New York</li> <li>• BanwartGJ ,1989. Basic Food Microbiology. AVI publishers</li> </ul>

## FTL 5 B 10 CEREALS, PULSES AND OIL SEEDS TECHNOLOGY (4Credits)

### Objectives:

- To introduce science & technology associated with cereals, pulses & oil seeds.
- To exposure to various baking technologies including bread, cake, biscuit and confectionaries.
- To provide a good knowledge on processing technologies related to rice, wheat, millets, pulses, nuts and oilseeds.

**Learning outcomes:**

- Familiarize on milling technologies of rice & wheat.
- Knowledge on baking technologies of bread, cake, biscuit and confectionary.
- Knowing the processing methods of pulses, nuts and oilseeds.
- Detailed description of millet chemistry.

SI No:	Topic	Course outline	Hrs
1	<b>Technology of Wheat and Rice</b>	<p><b>Wheat</b> Milling of wheat, by-products – Whole Wheat flour, Maida, Semolina, Gluten.</p> <p><b>Rice</b> Milling of rice, by-products of rice milling – Husk, Bran, Broken rice. Parboiling- Merits and demerits, Curing and Aging of rice, Rice products – Flaked rice, Puffed rice.. Corn:Types, Nutritivevalue, Dry&amp; Wet Milling,</p> <p><b>Technology of Oats and Barley</b></p>	15
2	<b>Bakery and Confectionary</b>	<b>Baking</b> Principles of baking, Classification of baked foods.	4
		<b>Bread:</b> Bread making –Role of ingredients, Bread faults & remedies, staling of bread.	10
		<b>Cake:</b> Cake making, Role of ingredients, Types of making, Cake faults and remedies.	9
		<b>Biscuit:</b> Biscuits & Cookies, Crackers and Wafers, technology of Biscuits, faults & Remedies.	8
		<b>Confectionary:</b> Raw materials, Hard candy, Toffee, Caramel.	
3	<b>Millets</b>	Pearl millet, Finger millet. Sorghum	5
4	<b>Pulses</b>	Processing- Soaking, Germination, Decortication, Cooking and Fermentation. Changes during germination, Antinutritional	5

		factors, Factors affecting cooking time.	
5	<b>Nuts &amp; Oil Seeds</b>	Sources, Composition, Processing of oil seeds – Soya bean, Coconut. Hydrogenation. Refining of fats & oils, Bleaching, De-odourising, Hydroxylation, Shortening, Margarine. Protein isolates, Texturised Vegetable Protein. Nuts-protein concentrates, Low cost protein foods.	8

### Reference

1. Technology of Wheat and Rice	<ul style="list-style-type: none"> <li>• S. Manany, N S. Swamy Food Facts and Principles. New Age International Publishers</li> <li>• Srilakshmi B. Food Science . New Age International Publishers</li> <li>• Sahay KM &amp;. Singh KK, 1994. Unit operations of Agricultural processing Vikas Publishing House</li> <li>• F.J.B. Reifschneider, S. Hussain, in Encyclopedia of Grain Science, 2004</li> <li>• Dendy D A V &amp; Dobraszczyk BJ Cereals and cereal products, Aspen</li> <li>• Kent NL 1983 Technology of cereals Pergamon press</li> <li>• J.R.N. Taylor, in Encyclopedia of Grain Science, 2004</li> <li>• Vijayakhader. Text book of Food Science and Technology. ICAR</li> </ul>
2. Bakery and confectionary	<ul style="list-style-type: none"> <li>• Hui, Y.H, Bakery products, Science and Technology , Black Well publishing, 2006</li> <li>• Matz S.A; Bakery Technology and Engineering; 3 edn, CBS Publishers and distributors</li> <li>• Faridi H, The science of cookie and cracker production; CBS Publishers and distributors</li> <li>• E J Pyler. Bakery science Technology. Vol I, II. Sosland Publications.</li> <li>• Manley D. 2000. Technology of Biscuits, Crackers and Cookies. CRC press.</li> <li>• Faridi H. Science of Cookie &amp; Cracker Production</li> </ul>



3.Millets	<ul style="list-style-type: none"> <li>• J.R.N. Taylor, in Encyclopedia of Grain Science, 2004</li> <li>• Leder ,Sorghum and millets, Cultivated Plants, Primarily as Food Sources ,2004</li> <li>• F.J.B. Reifschneider, S. Hussain, in Encyclopedia of Grain Science, 2004</li> <li>• Dendy D A V &amp; Dobraszczyk BJ Cereals and cereal products, Aspen</li> <li>• Kent NL 1983 Technology of cereals Pergamon press</li> <li>• M.I. Gomez, S.C. Gupta, in Encyclopedia of Food Sciences and Nutrition (Second Edition), 2003</li> </ul>
4.Pulses	<ul style="list-style-type: none"> <li>• Srivastava RP &amp; Kumar S .2003 Fruit and Vegetable preservation Principles and Practices. Interntional Book Distributors</li> <li>• Chakraverthy, A. (1995). Post harvest technology of cereals, pulses and oilseeds. Oxford &amp; IBH publishing Pvt. Ltd</li> <li>• Pandey, P. H. (1998). Principles and Practices of Post Harvest Technology. Kalyani publishing Pvt. Ltd</li> <li>• Sahay KM &amp; Singh KK, 1994. Unit operations of Agricultural processing, Vikas Publishing House</li> <li>• Chavan, U. D. (2012). Post Harvest Management and Processing Technology: cereals, pulses, oilseeds, fruits and vegetables. Daya Publishing house</li> <li>• Srilakshmi B. Food Science . New Age International Publishers</li> <li>• S. Manany, N S. Swamy Food Facts and Principles. New Age International Publishers</li> <li>• Vijayakhader.Text book of Food Science and Technology. ICAR</li> </ul>
5.Nuts & Oil seeds	<ul style="list-style-type: none"> <li>• S. Manany, N S. Swamy Food Facts and Principles. New Age International Publishers</li> <li>• Srilakshmi B. Food Science. New Age International Publishers</li> <li>• Sahay KM &amp; Singh KK, 1994. Unit operations of Agricultural processing Vikas Publishing House</li> <li>• Vijayakhader.Text book of Food Science and Technology. ICAR</li> <li>• Srivastava, P. K. and Kachru, R. P. (1995). Compendium of technologies for oil seed processing and utilization. Central Institute of Agricultural Engineering, Bhopal.</li> </ul>

	<ul style="list-style-type: none"> <li>• Chakraverthy, A. (1995). Post-harvest technology of cereals, pulses and oilseeds. Oxford &amp; IBH publishing Pvt. Ltd</li> <li>• Pandey, P. H. (1998). Principles and Practices of Post-Harvest Technology. Kalyani publishing Pvt. Ltd</li> <li>• Chavan, U. D. (2012). Post-Harvest Management and Processing Technology: cereals, pulses, oilseeds, fruits and vegetables. Daya Publishing house</li> </ul>
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### FTL 5 B 11 FOOD PRESERVATION & PACKAGING TECHNOLOGY (3 Credits)

#### Objectives

Food preservation prevents undesirable changes in the wholesomeness, nutritive value or sensory quality of food and reduces chemical, physical and physiological changes of an objectionable nature and eliminates contamination. The goal of food preservation is to increase the shelf life of a food while keeping it safe. It ultimately ensures its supply during times of scarcity and natural drought. By means of both enormous reduction in spoilage of perishable foods by preservation and newly developed products it is possible to build up country's economy by making more food available to the people at affordable prices.

#### Learning Outcomes

The core paper on Technology of Food Preservation enables the students to:

- Understand the master technologies of thermal food processing which governs most food industries.
- Signify the importance of various drying methods
- Make knowledge on pros and cons of low temperature preservation
- Optimize the idea on how ionizing radiation can be used for food preservation
- Rely on ancient fermentation method and its application.
- Clear the usual confusion for using various chemical preservatives.
- Dominate the common preservation techniques with the recent and advanced one.
- To be competitive with innovative ideas for developing substantial consumer products.

SI No:	Topic	Course outline	Hrs
1	<b>Thermal Processing</b>	Principles and application–Blanching, Pasteurization, Sterilization, Ultra High Temperature Sterilization, Canning, Aseptic processing.	5

2	<b>Drying</b>	Significance: Sun and Solar drying, Dehydration- Hot air drying, Drying Pre-treatments–sulphuring & Sulphiting, Dehydrofreezing, Freeze drying.	8
3	<b>Low Temperature Processing</b>	Refrigeration, Chilling <b>Freezing</b> , Principle, Freezing rate, Quick freezing, Slow freezing, . Quality of frozen foods- Retrogradation, Protein denaturation, Freezer burn.	5 3
4	<b>Irradiation</b>	Source of ionization irradiation, Dose and Dosimetry, Mode of action, Scope of irradiation.	3
5	<b>Fermentation</b>	Principles, Significance, Types of fermentation- Acetic, Lactic and Alcoholic.	3
6	<b>Chemical Preservation</b>	Natural preservatives-Mode of action. Chemical Preservatives - Sulphur Dioxide, Benzoic Acid, Sorbic Acid, Prop ionic acid, Acetic acid.	4
7	<b>Introduction to Food Packaging</b>	Definition, functions & Properties. Classification of packaging – Primary, Secondary, Tertiary Packaging. Flexible, Rigid & Semi rigid Packaging materials.	4
8	<b>Types of Packages &amp; Technologies</b>	Metal, Glass, Paper, Plastic, Retort able Pouches, CAP, MAP, Smart, Active, Aseptic, Biodegradable, Edible packages. Packaging Symbols, Nutritional Labelling. FOOD SAFETY AND STANDARDS (PACKAGING AND LABELLING) REGULATIONS, 2011	10

## References

1. Thermal Processing	<ul style="list-style-type: none"> <li>• Potter, N. N, Hotchkiss, J. H. Food Science. CBS Publishers, New Delhi. 2000.</li> <li>• Murano, Peter S. Understanding Food Science and Technology .Thomson</li> <li>• ShafiurRahman M., 1999, Hand book of food preservation. Marcel Dekker, Inc, New York.</li> <li>• S. Manany, N S. Swamy Food Facts and Principles. New Age International Publishers</li> <li>•</li> </ul>
2. Drying	<ul style="list-style-type: none"> <li>• Khader, Vijaya Textbook on Food Storage and Preservation Kalyani Publishers</li> <li>• Fennema Owen R. Princi[les of food Science. Marcel Dekkar, Inc</li> <li>• S. Manany, N S. Swamy Food Facts and Principles. New Age International Publishers</li> <li>•</li> </ul>
3. Low temperature processing	<ul style="list-style-type: none"> <li>• Potter, N. N, Hotchkiss, J. H. Food Science. CBS Publishers, New Delhi. 2000.</li> <li>• ShafiurRahman M., 1999, Hand book of food preservation. Marcel Dekker, Inc, New York</li> <li>• Fellow, P.J, Food processing technology: Principles and Practice. 3<sup>rd</sup> edition</li> <li>• Pruthi JS Quick Freezing Preservation of Foods Allied publishers Limited</li> <li>• . S. Manany, N S. Swamy Food Facts and Principles. New Age International Publishers</li> <li>•</li> </ul>
4. Irradiation	<ul style="list-style-type: none"> <li>• Potter, N. N, Hotchkiss, J. H. Food</li> </ul>

	<p>Science. CBS Publishers, New Delhi. 2000.</p> <ul style="list-style-type: none"> <li>• Manay, N.S, Shadaksharaswamy, M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.</li> </ul>
5.Fermentation	<ul style="list-style-type: none"> <li>• ShafiurRahman M., 1999, Hand book of food preservation. Marcel Dekker, Inc, New York.</li> </ul>
6.Chemical Preservation	<ul style="list-style-type: none"> <li>• Srivastava, R.PO and Kumar, S. Fruit and vegetable preservation, International Book distribution Company, Lucknow, 1994.</li> <li>• Desrosier NW James N,1977 Technology of Food Preservation CBS Publishers</li> <li>• ArtiSanhla Food Preservation. Principles and practices</li> <li>• Manay, N.S, Shadaksharaswamy, M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.</li> </ul>
7 and 8.Packaging Technology	<ul style="list-style-type: none"> <li>• Mathlouthi,M Food Packaging and Preservation .Aspen</li> <li>• Larousse, Jean FoodCanningTechnology</li> <li>• Mahadeviah M &amp;Gowramma RV 1996 Food Packaging Materials. Tata McGraw Hill</li> <li>• Painy FA.1992 A Hand Book of Food Packaging. BlackieAcademic</li> <li>• Stanley S &amp; Roger CG 1970 FoodPackagingAVIPubl</li> <li>• Gupta,Ajay KR Handbook on Modern Packaging Industries Asia Pacific Business Press Inc</li> <li>• Srinivasa Gopal TK SeaFoodPackaging</li> <li>• Robertson, Gordon L. Food Packaging Marcel Dekker Inc.</li> <li>• Hand book of Packaging Technology. Engineering India ResearchInstitute.</li> </ul>

## FTL 5 B 12 P CEREALS, PULSES & OIL SEEDS TECHNOLOGY

### Objectives

- To learn the importance of analysis of chemical parameters for the making of value-added products
- To develop the skills of making products from the resources.

### Learning Outcomes

On completion of the course, students are able to

- Demonstrate the importance of raw material chemical analysis for the quality of finished goods
- Develop skill on product making process and quality assurance

SI No:	Practicals
1	Determination of Moisture
2	Determination of Ash
3	Sedimentation value
4	Determination alcoholic acidity
5	Estimation of Gluten
6	Determination of Water absorption power
7	Qualitative analysis of gluten – Belshanke value
8	Determination of falling number
9	Preparation of Bread

10	Preparation of Biscuit
11	Preparation of Cake
12	Determination of Physical parameters of wheat and rice
13	<b>Industrial Visit III: Food research institute/industry.</b>

### FTL5B13 P FOOD MICROBIOLOGY II

#### Objectives

1. To study the methods of isolation and culturing of microorganisms
2. To analyse different types of specimens microbiologically:
  - Incoming raw material such as meat
  - Water -treated & raw water for coliforms
  - Microbial flora in foods such as milk

SI No:	Practicals
1	Isolation of pure culture: Pourplate, Streak plate
2	Microbial analysis of meats – Total plate count – <i>Staphylococcus</i>
3	Microbial analysis of Milk- Total plate count, Spices-Yeast and Mold,TPC
4	Microbial analysis of water – Coliforms
5	PracticalsBiochemical tests -oxidase, catalase, indole test, MR-VP test

### FT 5 B 14 P ANALYSIS OF FOODS (2 Credits)

#### Objectives

- To learn the importance of chemical analysis of foods
- To develop skills in laboratory techniques and practices
- To compare the results with standards laid down by authority

### Learning Outcomes

On completion of the course, students are able to

- Get accuracy result on various practical done
- Develop skill on laboratory practices
- Demonstrate the results compared with standards given by authority and regulations
- Educate the people with any adulteration or violation of the product

SI No:	Practicals
1	Determination of reducing sugar, total reducing sugar in honey/ jaggery / sugar (Lane & Eynone Method).
2	Determination of Fructose: glucose ratio in honey (Iodimetry).
3	Determination of Gum Base Content in Bubble gum/ chewing gum/ Cocoa butter (soxhlet extraction method)
4	Detection and identification of synthetic food colours (Paper chromatographic method/ TLC)
5	Determination of Fat content in cocoa butter
6	Determination of acidity of extracted fat in cashewnuts / biscuits (Soxhlet extraction method)
7	Estimation of crude fibre in fruits
8	Estimation of starch content in vegetables
9	Estimation of Protein (Colorimetric method) content in food
10	Estimation of invert sugar in Jaggery / Honey



11	Test for chicory in coffee
12	Determination of Peroxidase enzyme
13	Rehydration ratio of dried foods

### References

<ul style="list-style-type: none"> <li>• Ranganna S 2001. Hand book of analysis and quality control of fruits and vegetable products Tata- McGraw- Hill. .</li> <li>• Nielson S 1994 Introduction to Chemical Analysis of Foods Jones &amp; Bartlett</li> <li>• Pomrenz Y &amp; Meloan CE 1996 Food Analysis Theory and Practice CBS</li> <li>• Food Safety Standard authority of India site manual</li> </ul>
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### FTL 6 B 15 E DAIRY TECHNOLOGY (3 Credits)

#### Objectives

Knowledge and experience to manufacture safety and high-quality dairy products

#### Learning Outcomes

- Lists the components of milk.
- Signify the importance of physico chemical properties of milk.
- Providing the importance of dairy processing technologies and equipment used.
- Make more knowledge on different types of market milk and fermented milk products
- Provide more information on CIP methods.

SI No:	Topic	Course outline	Hrs
1	<b>Composition</b>	Composition of milk from various sources, factors affecting composition of milk.	6
2	<b>Properties</b>	Physical and Chemical properties- Flavour, Colour, acidity, viscosity, Specific gravity, Freezing point, Boiling point, Effect of- heat, enzymes, acids and alkali.	7
3	<b>Types of Milk</b>	Toned, Double toned milk, Standardized milk,	6

		Homogenized milk, and Recombined milk. <b>Quality control for milk-</b> Definition of quality, quality control and assurance-platform tests- Temperature, organoleptic tests, Alcohol test, Alcohol-Alizarin tests clot on boiling tests, Resazurin test. Detection of adulterants- starch, urea. Preservatives- carbonates, bicarbonates formalin.	
4	<b>Processing of Milk</b>	Processing, distribution and storage of liquid Milk. Calculation of Mass balance	4
5	<b>Dairy Products</b>		
	<b>a) Cream and Butter</b>	Composition, Processing and Technology. Theories and factors affecting churning	4
	<b>b) Ice cream</b>	Technology of Ice cream: Ingredients, formulations, Freezing, Hardening, Storage, Distribution and defects. Frozen dessert.	5
	<b>c) Cheese</b>	Introduction, Classification of cheese. Processing of cheese: Cottage and Cheddar.	4
	<b>d) Fermented Milk Products</b>	Curd, Yoghurt, Acidophilus milk, Kefir, koumiss, Probiotic	3
	<b>e) Milk powder</b>	Whole and skim milk powders, Instant milk powder.	5
6	<b>Technology of Dairy by-products</b>	Whey protein products.	1
7	<b>Dairy plant sanitation</b>	Objectives, CIP, Sanitizers.	3

## References

1&2. Composition, Properties	<ul style="list-style-type: none"><li>• Sukumar D E. Outlines of Dairy Technology, Oxford University Press.</li><li>• Eckles, Clarence, Henry Milk and Milk Products, TataMCGraw Hill publishers</li></ul>
3.Types of Milk	<ul style="list-style-type: none"><li>• Sukumar D E. Outlines of Dairy Technology, Oxford University Press.</li><li>• Eckles, Clarence, Henry Milk and Milk Products, TataMC Graw Hill publishers</li><li>• Ananthkrishnan C P, Khan A Q, Padmanabhan P N. Technology of Milk Processing. Sri Lakshmi Publishers.</li></ul>
4,5,6,7,8.,9&10 Processing of Milk Dairy Products Cream and Butter, Ice cream, Cheese, Fermented milk Products, Milk powder Dairy plant sanitation	<ul style="list-style-type: none"><li>• Sukumar D E. Outlines of Dairy Technology, Oxford University Press.</li><li>• Eckles, Clarence, Henry Milk and Milk Products, TataMCGraw Hill publishers</li></ul>

## FTL 6 B 16 TECHNOLOGY OF ANIMAL FOODS (4 Credits)

### Objectives

The course provides a good knowledge on the basic principles involving in animal food industry which includes selection of raw materials, slaughtering techniques, preservation Technologies, by product utilization of meat , poultry and fish .

### Learning Outcomes

By the end of the course, the student should be able to:

- Understand the importance of safe slaughtering methods and its significance in food safety.
- Innovative ideas on the production of various products
- Describe the methods of preservation of different animal products based on their shelf life
- Quality parameters of egg and the preservation methods from ancient to modern technologies
- A clear idea on fish processing Technology.

SI No:	Topic	Course outline	Hrs
1	<b>Slaughter and Inspection of Meat</b>	Humane method, Inspection of meat- Ante mortem and post-mortem inspection. Slaughter of sheep, pigs, poultry. Post mortem changes, ageing. Structure of meat, Factors affecting tenderness of meat, Effect of cooking on texture, colour and flavour. Ultimate PH ,Cold shortening, Meat tenderization ,Role of enzymes in meat processing , Electrical stimulation, Factors affecting quality of meat	10
2	<b>Cured Meat</b>	Role of ingredients, Methods of curing, Processing of Ham, Bacon. Sausage - classification, emulsion, ground sausage, processing, casings, Factors affecting quality of cured meat.	10
3	<b>Preservation</b>	Refrigeration, freezing, thermal processing, dehydration, irradiation, chemical, antibiotics.	8
4	<b>By products</b>	Rendering, Feeds, Hides, Skins, Hoofs, Horns.	6
5	<b>Egg</b>	Grading, Changes during storage. Egg quality- Factors affecting egg quality, Measures of egg quality, Effect of cooking, Factors affecting coagulation, Industrial use of egg. <b>Preservation of egg</b> Refrigeration, Freezing, Thermal processing, Dehydration, Coating.	14
6	<b>Fish &amp; Fish Products</b>	Introduction, Spoilage indices <b>Preservation</b> Cold storage, Freezing, Smoking, Pickling, Canning of fish, Drying <b>Fish products</b> Fish protein concentrate, Fish oils- Body oil, Liver oil, Fish meal, Fish	16

## References

<p><b>1. Slaughter and Inspection of Meat</b></p>	<ul style="list-style-type: none"> <li>• Gracey JF Collins DS Meat Hygiene ELBS,</li> <li>• Mountney T. Carmen G Prakhurst R Poultry Products Technology, CBS Publishers,</li> <li>• Shakuntala Maney Food Facts and principles,</li> <li>• B. Sreelakshmi, Food Science</li> <li>• G. Subbulaksmi, Food processing and preservation</li> </ul>
<p><b>2. Cured Meat</b></p>	<ul style="list-style-type: none"> <li>• Gracey JF Collins DS Meat Hygiene ELBS,</li> <li>• Person AM Gillet T A Processed Meats. CBS publishers,</li> <li>• Lawrie R A Lawries Meat ScienceTataMcGrawHhill</li> </ul>
<p><b>3. Preservation</b></p>	<ul style="list-style-type: none"> <li>• Gracey JF Collins DS Meat Hygiene ELBS</li> <li>• Lawrie R A Lawries Meat ScienceTataMcGrawHhill</li> <li>• G. Subbulaksmi, Food processing and preservation</li> </ul>
<p><b>4. By products</b></p>	<ul style="list-style-type: none"> <li>• Ockerman H W Hancen C L Animal Byproduct Processing Elis Horwood</li> </ul>
<p><b>5. Egg</b></p>	<ul style="list-style-type: none"> <li>• Gopakumar K Tropical Fishery Products Oxford</li> <li>• Jhingran VG Fish &amp; Fisheries of India Hindustan Publishing Company</li> <li>• Biswas KP A Text Book of Fish and Fisheries Technology Tata McGraw hill</li> </ul>
<p><b>6. Fish &amp; Fish Products</b></p>	<ul style="list-style-type: none"> <li>• Stadelman, William J...Egg Science and Technology. CBS.</li> <li>• Parkhurst, Carmen R .Poultry Meat and Egg Production.CBS</li> </ul>

## FTL 6 B 17 FOOD SAFETY, FOOD LAWS&REGULATIONS (4 Credits)

### Objectives

The major objective of this course is to teach the students to understand the concept of food safety and quality management. Students can understand the fundamentals of food sampling, food adulteration and packaging technology. Students can also understand the overall requirements for the food plant sanitation. Students can learn about the current food laws and regulations.

### Learning Outcome

- Upon completion of the food safety regulations and packaging paper students will be able to understand the importance of food safety and hygiene and can apply it at industrial level.

- Students will recognize the national and international standards and practices for food safety and can implement it at industries.
- Students can take new concept of food plant sanitation and apply them to another situation.
- Students can implement the updated FSSAI act at analysis as well as production level.

### FTL 6 B 16 Food Safety, Food Laws & (4Credits)

SI No:	Topic	Course outline	Hrs
1	<b>Food safety ,Hygiene and Quality Management</b>	Importance of Food Safety, Food Hygiene, High risk food, Low risk food, Danger Zone, Personal hygiene. GHP, GMP, SOP, HACCP(Food contaminants- Physical, Chemical, Biological and Allergens), ISO 22000-2005, ISO 9001	10
2	<b>Food Laws &amp; Regulations</b>	Food Safety and Standards Act,2006, FSSAI – Organizational chart and role of individual authority – Enforcement of the act – Food safety officers and their powers – Regulations pertaining to Food analysis labs - Offences and penalties	10
3	<b>International Regulatory bodies</b>	International intergovernmental food regulation bodies such as - Codex Alimentary Commission, World Health Organization, USFDA. , Food and Agriculture Organization,	8
4	<b>Food Adulteration</b>	Common Food adulterants and its relevance in Milk, Vegetable oil, Spices, Tea, Pulses, Sugar, Honey	10
5	<b>Trade standards</b>	Bureau of Indian Standards, APEDA,AGMARK,,MPEDA,EIA	5
6	<b>Traceability &amp; Recalling</b>	Objectives and Mechanism	5
7	<b>Food Plant Cleaning &amp; Sanitation</b>	Structural requirements, SSOP, CIP, Chlorination, Detergents, Disinfectants and Sanitizers	8
8	<b>Food Sampling</b>	Objectives, Sample collection, Sampling tools, Sampling procedure	8

## References

1. Food safety and hygiene	<ul style="list-style-type: none"> <li>• Sunetra Rodey. "Food hygiene and sanitation with case studies"</li> <li>• Richard A Sprenger, "Hygiene for Management" High field</li> </ul>
2. Food safety and Quality Management	<ul style="list-style-type: none"> <li>• Puja Dudeja; Amarjeet Singh; "Food safety implementation from farm to fork"</li> </ul>
3. Traceability & Recalling	<ul style="list-style-type: none"> <li>• Guideline for food recall-FSSAI</li> </ul>
4. Food plant sanitation	<ul style="list-style-type: none"> <li>• Sunetra Rodey. "Food hygiene and sanitation with case studies"</li> </ul>
5. Food laws & Regulations	<ul style="list-style-type: none"> <li>• Sukhneet Suri, Anita Malhotra; "Food science Nutrition and safety". FSSAI Manual; www.fssai.gov.in</li> </ul>
6. Food Adulteration	<ul style="list-style-type: none"> <li>• B Sreelekshmi; "Food science"</li> </ul>
7. Food Sampling	<ul style="list-style-type: none"> <li>• FSSAI manual on general guidelines on sampling</li> </ul>
	<ul style="list-style-type: none"> <li>•</li> </ul>

## FTL 6 B 18 TECHNOLOGY OF FRUITS, VEGETABLES, SPICES & PLANTATION CROPS (4 Credits)

SI No:	Topic	Course outline	Hrs
1	<b>Post harvest Management</b>	<p>Maturity Indices, Ripening, Changes during ripening-Climacteric &amp; Non-Climacteric. Minimal processing. Storage practices, CA&amp;MA Storage, Hypobaric storage, Precooling &amp; cold storage, Zero energy Storage-. Primary processing, grading, sorting, cleaning, washing, peeling, slicing blanching, wax coating</p> <p>Fruits bars &amp; fruit toffee. Physiological disorders-chilling injury and post harvest diseases.</p>	6

2	<b>Pectin , Jam, Jelly and Marmalade</b>	Pectin Definition of Pectin, Classification, Pectic enzymes, Properties, jelly grade of pectin, Testing of pectin. Jam, Jelly and Marmalade- Definition.Jam making, jelly making, Defects.	6
3	<b>Fruits Juices &amp; Fruit Preparations</b>	<b>Fruit Juices</b> Ready to serve beverages, Squashes Cordials, Nectars, Concentrates Fruit juice powder- Freeze drying, Foam mat drying. <b>Fruit Preparations</b> Preserves, Candies Crystallized fruits & Glazed fruits. <b>Pickle and Chutneys</b> - Action of preservatives Pickling process, defects.	10
4	<b>Tomato Products</b>	Tomato juice, puree, paste& Ketchup specification of the above products.	6
5	<b>Canning</b>	<b>Classification of canning of fruits-</b> Pineapple, Oranges, Canning of vegetables - Peas, Carrots, syrups & brines for canning.	6
6	<b>Drying &amp; Dehydration</b>	Enzyme Inactivation, Sulphuring .Sun drying - Grapes and Dates. Dehydration of vegetables and Fruits.	4
8	<b>Spices</b>	Definition, Classification, Chemical Composition, uses of spices.	4
9	<b>Major Spices</b>	Refining and processing of pepper. Pepper products – white pepper, dehydrated green pepper. Processing of Turmeric,Ginger,Chillies and Cardamom. Spice oils & oleoresins.	8
10	<b>Tea, coffee &amp; Cocoa</b>	Chemical composition, processing & grading	10



**FTL 6 B 19 P TECHNOLOGY OF FRUITS, VEGETABLES, SPICES & PLANTATION CROPS (3+2=5 Credits) Objectives**

- To learn different food preservation methods of fruits and vegetables

**Learning Outcomes**

On completion of the course, students are able to

- Understand various methods of preparation of fruits and vegetable based products
- Develop skill to analyze the quality of fruits and vegetable based products

SI No:	Practicals
1	Determination of Sulphur dioxide
2	Estimation of Vitamin C
3	Estimation of tannin – colorimetric method
4	Estimation of alcohol content
5	Determination of salt content in pickles
6	Determination of reducing sugar
7	Lye peeling
8	Adequacy of blanching
9	Preparation of ketchup
10	Preparation of Jam & Jelly
11	Preparation of squash

**References**

- Pandey PH Principle of Practices of post harvest Technology Kalyani publication
- Cruess WV., 1997. Commercial fruit and vegetables Products. Anees offset press, New Delhi.

- Lal, G Siddappa S and Tandon GL. Preservation of fruit and vegetables. ICAR
- Thompson AK 1995 Post harvest Technology of Fruits and Vegetables Black well Sci
- Verma LR & Joshi V.K .,2000 Post Harvest Technology of Fruits & Vegetables. Indus Publ
- Potter NN , Hotchkiss JH. Food Science. CBS Publishers
- Manay S, N S. Swamy Food Facts and Principles. New Age International Publishers
- Srivastava RP & Kumar S .2003 Fruit and Vegetable preservation Principles and Practices. International Book Distributor

### FTL 6 B 20 P TECHNOLOGY OF ANIMAL FOODS (5 Credits)

#### Objective

- To perform various platform tests for milk
- To identify the difference between milk packets
- To prepare khoa or peda by using milk

#### Learning Outcomes:

- To determine the acidity of milk, curd, butter
- By using Gerber method we can check the fat of milk
- By using lactometer we can check the purity of cow's milk
- Different kind of test are performing to determine the adulteration of milk

SI No:	Practicals
1	Acidity of Milk & curd
2	Fat content in Milk
3	Determination of total solids, SNF and specific gravity of milk
4	Determination of Total ash in milk
5	Acidity of butter
6	Moisture content of butter
7	Salt content in butter
8	Adulteration in milk
9	Preparation of Khoa, Peda

10	Moisture content in Ghee
11	FFA of Ghee
12	Internal & External quality of egg
13	Proximate composition of Meat & Fish

### Open course

#### FT5D01 TECHNOLOGY OF SPICES (3 Credits)

##### Objectives

- To understand the basic knowledge about Major spices and its products.
- To know the Chemical composition of spices and manufacturing technology of Spice oil and oleoresins.
- To get the knowledge about processing technology of major Spices.

##### Learning Outcomes

- Exposure to various processing Technology in Spices.
- Understand the importance of Spices in Food industry.
- Acquire knowledge about major spices and its products.

SI No:	Topic	Course outline	Hrs
1	<b>Spices, Spice oils &amp; Oleoresin</b>	Definition, Classification, Chemical composition, Use of Spices. Spice oil and Oleoresins—Definition, Technology of Manufacturing	10
2	<b>Major Spices: Pepper</b>	Refining and processing of pepper Pepper products:- White pepper, dehydrated green pepper, Pepper oil, Oleoresin.	10

<b>Chillies</b>	Drying of chillies, quality attributes of chillies and paprika	7
<b>Cardamom</b>	Composition, Drying of fruits, Bleaching, Grading, Cardamom products, Essential oil and oleoresins	7
<b>Ginger</b>	Curing, Bleaching, Grading Ginger Products, Ginger oils, Ginger oleoresin, Dehydrated Ginger, Bleached Ginger	7
<b>Turmeric</b>	Curing, Grading, Turmeric powder, Essential oil, oleoresin	7

### References

1.Spices, Spice oils & Oleoresin	<ul style="list-style-type: none"> <li>• Major Spices of India J S Pruthi</li> <li>• Quality assurance in spices and spice products J S Pruthi</li> <li>• Handbook on Spices and Condiments(Cultivation, Processing and Extraction), H.Panda</li> </ul>
2.Major Spices: Pepper, Chillies,Cardamom,Ginger,Turmeric	<ul style="list-style-type: none"> <li>• Major Spices of India J S Pruthi</li> <li>• Quality assurance in spices and spice products J S Pruthi</li> <li>• Handbook on Spices and Condiments(Cultivation, Processing and Extraction), H.Panda</li> </ul>

### FTL 5 D 02 FRUITS AND VEGETABLES PROCESSING (3Credits)

#### Objective

- To introduce science and technology associated with fruit and vegetable processing.
- To know about the principles in processing of fruit and vegetable.
- To understand the quality specification of different fruit and vegetable products.

#### Learning Outcome

- Be able to recognise and classify the various types of fruit and vegetable.
- Understand the physiological changes occurring to fruit and vegetable during processing and storage.
- Be familiar with the processing techniques used for fruit and vegetable.
- Establish the quality specification for the processing of fruit and vegetable.

SI No:	Topic	Course outline	Hrs
1	<b>Fruits and Vegetables</b>	Definition, Composition, Classification, Nutritive value, changes during ripening. Flavors of Fruits and Vegetables. Vegetable cookery, changes during cooking Browning and its prevention	15
2	<b>Preservation of Fruits and Vegetables</b>	Heat, Salt, Sugar, Freezing, Food additives	9
3	<b>Fruit and Vegetable Products</b>	Fruit Juice, Squashes, Cordials, Nectar, Concentrates, Fruit juice Powder, Jam, Jelly. Different types of Pickles and Chutneys. Product Specification	15
4	<b>Tomato Products</b>	Tomato juice, Puree, Paste, Ketchup	9

#### References

Fruit and vegetable	Food science :Norman.N.Potter,Joseph. H. Hotchkis Manany S, N.S.Swamy;Food facts and principles New age international publishers Enzymatic browning and it's prevention; Chang.Y.Lee,John.R. Whitaker.
Preservation of fruit and vegetable	Preservation of fruit and vegetable :Gridharilal, G.S.Siddappa and G. L.Tandon Fruit and vegetable preservation and practices;Kumar Sanjeev and R.P Srivastava.
Fruit and vegetable products	Commercial fruit and vegetable products;W. V. Cruess, Fruit and vegetable processing;Sumanbhatti
Tomato products	The complete book on tomato and tomato products manufacturing;NCPS board of consultants and engineers.

	Fruit and vegetable preservation and practices;Kumar Sanjeev and R.P Srivastava. Preservation of fruit and vegetable :Gridharilal, G.S.Siddappa and G. L.Tandon
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### **FTL5D03 FOOD AND HEALTH (3 Credits)**

#### **Objectives**

1. To understand the basic concept of food which includes classification, Nutritional composition, Different sources, recommended dietary allowance and various methods of nutrient measurement on body requirement.
2. To provide knowledge about food additives, Food adulteration, and Food Poisoning.

#### **Learning Outcomes**

- Familiarize basic knowledge of foods includes Nutritional Composition

- Knowledge about Life style diseases and food related diseases.
- acquire knowledge about various food additives and Food adulteration
- Understand Food allergens and Food poison.

SI No:	Topic	Course outline	Hrs
1	<b>Introduction to Food</b>	Definition, Types and classification of Food-junk food, functional food, Nutritional composition of Food-Carbohydrate, Protein, Fat, Water, Mineral, Vitamins, Food Groups. Sources of Food - carbohydrate, protein, fat. Recommended daily allowance of nutrients. Types of work and energy requirements. Body Mass Index	12
2	<b>Life Style and Food Related Diseases</b>	Obesity, Diabetics, cardio vascular Disease, constipation, Intolerance-Lactose & Gluten, Chinese Syndrome	12
3	<b>Food Additives</b>	Definition, importance in food preparation, functions of Food additives -anti-oxidants, preservatives, coloring agent, flavours, and emulsifiers.	8
4	<b>Food Adulteration</b>	Definition, common adulterants found in food.	8
5	<b>Food Allergens and Food Poisoning</b>	Common food allergens. Food poisoning, symptoms and control , <i>Botulism</i> , <i>Staphylococcus</i> , <i>E.coli</i> and <i>salmonella</i>	8

### References

1.Introduction to Food	<ul style="list-style-type: none"> <li>• Fundamentals of Food &amp; Nutrition S R Mumbai &amp; M V Rajagopal</li> <li>• Handbook of Food &amp; Nutrition M Swaminathan</li> <li>• Nutrition Science Srilakshmi,B</li> </ul>
2.Life style and Food related diseases	<ul style="list-style-type: none"> <li>• Natural Dietics,A Handbook on Food, Nutrition &amp; Health Jussawalla, J M</li> <li>• Fundamentals Of Food, nutrition &amp; Diet Therapy Sumati R Mumbai, Rajagopal, M. V</li> </ul>

	<ul style="list-style-type: none"> <li>• Educational Planning group. Food &amp; Nutrition, New Delhi</li> </ul>
3. Food Additives	<ul style="list-style-type: none"> <li>• Food Additives Handbook Lewis, Richard J</li> <li>• Hygiene &amp; public health Yashpal bedi</li> <li>• You &amp; your Health V. N. Bhave</li> </ul>
4. Food Adulteration 5. Food allergens and food poison	<ul style="list-style-type: none"> <li>• Hygiene &amp; public health Yashpal bedi</li> <li>• You &amp; your Health V. N. Bhave</li> </ul>

BSc FT Syllabus MES Autonomous-2021-22 (2019 Modified)



**Semester III**  
**General Common Course**  
**A11 BASIC NUMERICAL SKILLS**

**Total Hours: 80; Credits: 4Hours/Week: 5; Total Marks 100(Internal 20& External 80)**

**Objectives** To acquire knowledge on numerical equations, matrices, progression, statistical tools and its applications

**Course outcome (s)**

To understand set operations

To acquire knowledge on matrix and operation rules

To acquire knowledge on solving equations.

To understand progression, Statistical tools and their applications.

**Module I: Set Theory and Matrices (16Hours)**

Sets and Set Operation - Venn Diagrams - Elements of Co-ordinate system - Matrices -Fundamental ideas about matrices and their operational rules - Matrix multiplication - Inversion of square matrices of not more than 3rd order - Solving system of simultaneous linear equations.

**Module II: Equations (10 Hours)**

Theory of Equations : Meaning - types of equations - Simple linear and Simultaneous equations (only two variables) eliminations and substitution method only - Quadratic equation factorization and formula method ( $ax^2 + bx + c = 0$  form only) - Problems on business applications.

### **Module III: Progressions (16Hours)**

Progressions : Arithmetic Progressions - Finding the 'n'th term of an AP and also sum to 'n' terms of an AP - Insertion of Arithmetic means in given terms of AP and representation of AP - Geometric Progression : Finding 'n'th term of GP - Insertion of GMs in given GP and also representation of GP - Mathematics of Finance - Simple and compound interest (Simple problems only).

### **Module IV: Statistics (16 Hours)**

Meaning and Definition of Statistics - Scope and limitations - Statistical enquiries -Scope of the problem - Methods to be employed - Types of enquiries - Presentation of data by Diagrammatic and Graphical Method - Formation of Frequency Distribution.

### **Module V: Statistical Measures and Analysis (22 Hours )**

Measures of Central Tendency - Arithmetic Mean - Median - Mode - Geometric and Harmonic Mean - Measures of variation and standard, mean and quartile deviations -Skewness and Kurtosis - Lorenz curve. Analysis of Time Series: Methods of measuring - Trend and Seasonal variations - Index number - Unweighted indices -Consumer price and cost of living indices. (Theory and problems may be in the ratio of 20% and 80% respectively. An over view of the topics is expected and only simple problems shall be given)

#### References

1. Sundaresan and Jayaseelan - An Introduction to Business Mathematics and Statistical Methods.
2. Dr. A K Arte& R V Prabhakar - A Text Book of Business Mathematics.
3. Sanchethi and Kapoor- Business Mathematics.
4. Gupta S.P- Statistical Methods

5. Navaneethan P- Business Mathematics

6. R.S.N. Pillai, Mrs. Bhagavathi - Statistics

7. P.R. Vittal - Business Mathematics and Statistics.

Mark distribution	
Module 1	26
Module II	11
Module III	22
Module IV	23
Module V	28

### Semester III

#### A12 INFORMATICS AND EMERGING TECHNOLOGIES

**Total Hours: 80; Credits: 4; Hours/Week: 5; Total Marks 100 (Internal 20& External 80)**

**Objectives** To gain a basic knowledge of the Basic parts of a computer, operating systems, Scientific data bases, wireless communication, mobile phones and emerging Food technologies, biometrics and cyber security

**Course outcome (s)**

To understand about the basic parts of computer and its memory devices

To recognise scientific databases

To distinguish wireless technologies

To understand the emerging food technologies

To recognise the significance of cyber security

**Module I: Computers and Operating System (10 Hours)**

Computer-Evolution of computers-Basic ideas about the parts of a computer, Input devices, Output devices, Memory, Storage devices and Operating systems. Evolution of internet- Scientific data bases and useful educational websites.

**Module II: Wireless Communication, Mobile Phones and Online Learning (10 Hours)**

Wireless Communication: Introduction to Computer Networks .Types of networks-PAN, LAN, MAN,WAN. Net working Topologies- Mesh topology, Ring Topology, Bus Topology, Star Topology Tree and Hybrid Topology, . Mobile Phones-Smart Phones and phone applications. E- Learning. Mobile learning-Benefits and Problems. Online Teaching and Learning -Advantages and disadvantages

### **Module III Social Informatics (15 Hours)**

General issues related to social net working -Online shopping fraud-Hacking or gaining to social media accounts , Credit/Debit card Skimming, Social media frauds-Lottery fraud, Job related frauds, Romance Fraud, Cyber Stalking, Virus attack. E-commerce – Online banking –Advantages and Challenges. Good password practices. CIA Triad. Cyber crimes. Indian IT Act, 2008 and Amendment 2008.

### **Module IV Introduction to Biometrics (15 Hours)**

Introduction to biometrics - Fingerprint verification- Face recognition. (Basic Ideas Only) Hand geometry based verification - Recognizing persons by their Iris pattern. Retina identification. Automatic online signature verification- Speaker recognition – identification of faces and body parts. Large scale systems- Multimodal biometrics-Smartcard based authentication.

### **Module V Food Informatics (15 Hours)**

#### **1. Food Research Institutions and Industries**

Major centres of food research in India –CFTRI, DFRL, NIFTEM, IIFPT & CIFT. Major Food Industries in India.

#### **2. Food Categorisation**

Main Indian food categories as per FSSAI. Standardised and Proprietary foods.

#### **3. Food Commodity Authorities and Boards**

Kerala Cashew Board, Coconut Development Board, Tea Board of India , Coffee Board, **Spices Board of India**, The Indian Institute of Spices Research

### **Module VI Emerging Preservation Technologies (15 Hours)**

PEF, pulsed light Technology and ohmic heating: Pulsed electric field –mechanism of PEF-advantages, Pulsed light Technology principle and application Ohmic heating of foods- mechanism- principle- advantages, applications.

High pressure processing and Microwave heating: -Microwave heating of foods- Mechanism of Heat Generation-Working of microwave oven, Applications in Food Processing. High Pressure processing: Concept-Equipment for HPP Treatment-Mechanism of Microbial Inactivation and its Application in Food

Radio Frequency Processing: Definition, Advantages, mechanism of heat generation, application in food processing

Cold plasma, Oscillating Magnetic field, Ultrasonics Inductive heating, Electro osmosis - Principle and application

Nano technology-Application in food industry and Hurdle Technology

## References

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2. Introduction To Information Technology. Rajaraman, V. Phi Learning Pvt. Ltd., 2018
3. Novel Food Processing Technologies(Food Science and Technology Series) by Gustavo V. Barbosa-Canovas, Maria S. Tapia, M. Soledad Tapia, M. Pilar Cano, Publisher: CRC Press, November 2004, ISBN-13:978082475333
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CRC Press, 2016
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10. Introduction to Biometrics. Anil K. Jain, Arun A. Ross, Karthik Nandakumar. Springer Science & Business Media, 2011
11. Biometrics: Identity Verification in a Networked World. Samir Nanavati, Michael Thieme, Raj Nanavati. John Wiley & Sons, 2002
12. Information Technology: An Introduction for Today's Digital World. Richard Fox  
CRC Press, 2013
13. Data Processing and Information Technology. Carl French . Cengage Learning EMEA, 1996
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Michael M.A; and Morgenstern, Barbara L., Focal Press, 2004.

15. Chauhan, O. P., Non-thermal Processing of Foods. 1st Edition

16. Cyber Forensics. S. Murugan. Oxford University Press, 2018

17. Encyclopedia of Biometrics: Stan Z. Li. Springer Science & Business Media, 2009

Recent food Technologies—

18. Chauhan, O. P., Non-thermal Processing of Foods. 1st Edition

19 ShafiurRahman M., 1999, Hand book of food preservation. Marcel Dekker, Inc, New York.  
Subalakshmi, G and Udipi, S.A. Food processing and preservation. New Age International Publishers, New Delhi, 2001.

20. McWilliams, M and Paine, H. Modern Food preservation. Surjeet Publications, Delhi, 1984

21. Manay, N.S, Shadaksharaswamy, M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.

Mark distribution	
Module 1	10
Module II	10
Module III	15
Module IV	15
Module V	15
Module VI	15

#### Semester IV

#### A13 ENTREPRENEURSHIP AND ENVIRONMENTAL SCIENCE

**Total Hours: 80; Credits: 4; Hours/Week: 5; Total Marks 100 (Internal 20 & External 80)**

**Objective(s)** To acquire a detailed knowledge about the relationship between Entrepreneurship and sustainability with special emphasis on industrial pollution and its control measures

**Course outcome (s)**

To appreciate the role of Entrepreneur in Economic Growth

To recognise the contradicting nature of industrialization and sustainable development

To distinguish the types of pollution of water, air and land

To understand the basic principles and applications of pollution control methods

To recognise the significance of Environment policies and Regulations

**Module I -Fundamentals of Entrepreneurship (20 Hours)**

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur  
Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth. MSMEs –Definition and Significance in Indian Economy; MSME Steps for starting, promotion measures by government- Incentive & subsidy. Role of Promotional Institutions with Special Reference to KINFRA, KITCO. Identification of Business Opportunities in Kerala- Industrial policy, 2007. Measures to speedup industrial growth. ED Club-Mission, objectives & functions. Business Incubation-benefits & setting up incubation centre.

**Module II-Process of starting business (16 Hours)**

Search for business idea, sources of ideas, idea processing, input requirements : sources and criteria of financing, fixed and working capital assessment; technical assistance; marketing assistance; sickness of units and remedial assistance; preparation of feasibility reports and legal formalities and documentation.

**Module III-Environmental Concerns (12Hours)**

Industrial activity and environment, industrialization and sustainable development- indicators of sustainability-sustainability strategies. Barriers to sustainability, Pollution prevention in achieving sustainability Prevention vs control of industrial pollution, Environment policies and Regulations to encourage pollution prevention.

**Module IV-Pollution (16 Hours)**

Definition of pollutant, types of pollution; Air, Water, Land, noise- adverse effects of pollutants on eco system and human health - Need for effluent treatment and toxicity control.

**Module V -Pollution Control Methods (16Hours)**

Air standards for cities and industrial areas. Particulate emission control- gravitational settling chambers- cyclone separators, fabric filters, electrostatic precipitators, wet scrubbers, absorbers. Noise pollution and its control. Standards for portable water. Principles of water treatment -primary, secondary and tertiary treatments

## References

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2. Entrepreneurship development small business enterprises. Poornima M Charantimath, Pearson, 2013.
3. Environment and Sustainable Development , M.H. Fulekar, Bhawana Pathak, R K Kale, Springer Science & Business Media
4. Greening Industry: New Roles for Communities, Markets, and Governments, Volume 1 World Bank Publications, 2000
5. A Text Book Of Environmental Science, Arvind Kumar, APH Publishing, 2004
6. Pollution: Causes, Effects and Control. Roy M. Harrison, Royal Society of Chemistry, 2001
7. Industrial Chemistry, BK Sharma Krishna Prakashan Media, 1991
8. Water Pollution. Agarwal S. K. APH Publishing
9. Entrepreneurship: Theory And Practice, Raj Shankar, Vijay Nicole imprints  
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10. Entrepreneurship. 8 th Edition Robert D. Hisrich, Mathew J. Manimala, Michael P Peters and Dean A. Shepherd, Tata Mc-graw Hill Publishing Co.ltd.-new Delhi, 2012
11. The Design of Business. Martin Roger, , Harvard Business Publishing, 2009
12. Innovation and Entrepreneurship, Drucker.F, Peter, Harper business, 2006.
13. Environment Protection and Sustainable Development. Saligram Bhatt, APH Publishing, 2004
14. Pollution: Causes, Effects and Control. Roy M. Harrison, Royal Society of Chemistry, 2001

Mark distribution
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Module 1	21
Module II	16
Module III	24
Module IV	23
Module V	26

#### Semester IV

### A14 NUTRITION AND HEALTH

**Total Hours: 80; Credits: 4; Hours/Week: 5; Total Marks 100 (Internal 20& External 80)**

#### A 014 NUTRITION AND HEALTH (4 Credits)

#### Objectives

Nutrition and Health study deals with the importance of food and nutrients supplementation in human diet. It has an application in healthcare in daily life and for meal planning. In these decades the aware about dietary requirements and nutritive value of different food is leads to prevent malnutrition among people. The goal of this education is to reinforce specific nutrition related practices or behaviors to change habits that contribute to poor health; this is done by creating a motivation for change among the students, to establish desirable food and motivation behavior for promotion and protection of good health.

#### Learning Outcomes

- Developing supplementary nutrition program where ever necessary
- Provided information about appropriate diet.
- Increasing the nutrition knowledge and promoting desirable food behavior and nutritional practice.
- Acquired b
- asic knowledge of what constitute a nutritious diet and how people can best meet their nutritional needs from available recourses.
- Understanding the relationship between diet and health and to changing food and nutritional attitude.

Unit	Topic	Course outline	Hrs
1	<b>Concept of Health</b>	Definition of physical health, mental health, social health, spiritual health-determinants of	4

		health, indication of health	
2	<b>Concept of Nutrition</b>	Definition of terms: Nutrition, under nutrition, Malnutrition, Health & Nutritional status – adequate, optimum & good nutrition. Relation of good nutrition to normal physical development & sound health	6
3	<b>Energy</b>	Definition of Caloric & Joule. Measurement of calorific values of food, basal metabolism, specific dynamic action of foods, energy needs of body, measurement of energy balance of body	6
4	<b>Food Guide</b>	Nutrients supplied by foods. Basic food groups	4
5	<b>Carbohydrates</b>	Sources, Classification, digestion, absorption, transportation & utilization, functions, sources, requirements and effect of deficiency. Dietary Fibre- Definition, classification, sources, role of fibre in human nutrition	6
6	<b>Proteins</b>	Classification, digestion absorption, transportation & utilization, functions, sources & requirements. Essential aminoacids, evaluation of protein quality, supplementation and deficiency.	8
7	<b>Lipids</b>	Classification, saturated and unsaturated fatty acids, digestion, absorption, transportation & utilization, functions, sources & requirements and effect of deficiency	7
8	<b>Minerals</b>	Functions, sources, absorption and factors	6

		affecting the utilization of Calcium, Phosphorus, Iron, Iodine, Copper and Flouride, effects of deficiency	
9	<b>Vitamins</b>	Classification, functions, sources, factors affecting destruction, factors enhancing vitamins in foods, absorption, requirements & deficiency conditions – Vit A, D, E, K, Ascorbic acid, Thiamine, Riboflavin, Niacin, Pyridoxine, Folic acid, Pantothenic acid	6
10	<b>Water</b>	Importance, distribution in body, function sources, requirements, water balance	6
11	<b>Menu planning</b>	Significance of Menu Planning, Menu planning for family. Factors influencing meal planning.	4
12	<b>Nutrition and life.</b>	Nutrition for the normal life cycle, Nutrition during Pregnancy and Lactation. Nutrition for Fitness and Sports	3

## References

1. Concept of Health	<ul style="list-style-type: none"> <li>• Nutrition- concepts and controversies- Eleanor Whitney – Eighth Edition (2000)</li> <li>• Fundamentals of Food &amp; Nutrition S R Mudambi &amp; M V Rajagopal</li> <li>• Essential of food &amp; Nutrition –Vol. 1 M. Swaminathan, Bappco, Bangalore.</li> </ul>
2. Concept of Nutrition	<ul style="list-style-type: none"> <li>• Human Nutrition and Dietetics –Davidson S. Passmore</li> <li>• A text book of Foods, Nutrition and Dietetics- Begum, R.</li> </ul>
3. Energy	<ul style="list-style-type: none"> <li>• Understanding Nutrition -Whitney P.N. and Roes S.R., West Publication Co, 1996.</li> <li>• Nutrition Science- Srilakshmi, B</li> </ul>
4. Food Guide	<ul style="list-style-type: none"> <li>• Education planning group. Food &amp; Nutrition, 1980. Arya</li> </ul>

	publishing group, New Delhi <ul style="list-style-type: none"> <li>• Srilakshmi, B, Nutrition Science, New age international (P) Ltd publishers, New Delhi, 2006.</li> </ul>
5.Carbohydrates	<ul style="list-style-type: none"> <li>• Handbook of Food and Nutrition M Swaminathan</li> <li>• Nutrition Science- Srilakshmi, B</li> </ul>
6.Proteins	<ul style="list-style-type: none"> <li>• Essential of food &amp; Nutrition –Vol. 1 M. Swaminathan,Bappco,Bangalore.</li> </ul>
7.Lipids	<ul style="list-style-type: none"> <li>• Essential of food &amp; Nutrition –Vol. 1 M. Swaminathan</li> </ul>
8.Minerals	<ul style="list-style-type: none"> <li>• Essential of food &amp; Nutrition –Vol. 1 M. Swaminathan</li> </ul>
9.Vitamins	<ul style="list-style-type: none"> <li>• Essential of food &amp; Nutrition –Vol. 1 M. Swaminathan</li> </ul>
10.Water	<ul style="list-style-type: none"> <li>• Essential of food &amp; Nutrition –Vol. 1 M. Swaminathan</li> </ul>
11.Menuplanning	<ul style="list-style-type: none"> <li>• Nutrition Science- Srilakshmi, B</li> </ul>
12.Nutrition and Life	<ul style="list-style-type: none"> <li>• Nutrition Science- Srilakshmi, B</li> </ul>

## **FTL 6B15 E2 BEVERAGES TECHNOLOGY (4 CRDITS)**

### **Unit I (Lectures 20)**

Types of beverages and their importance; status of beverage industry in India; Manufacturing technology for juice-based beverages; synthetic beverages; technology of still, carbonated, low-calorie and dry beverages; isotonic and sports drinks; role of various ingredients of soft drinks, carbonation of soft drinks.

### **Unit II (Lectures 15)**

Specialty beverages based on tea, coffee, cocoa, spices, plant extracts, herbs, nuts, dairy and imitation dairy-based beverages.

### **Unit III (Lectures 25)**

Alcoholic beverages- types, manufacture and quality evaluation; the role of yeast in beer and other alcoholic beverages, ale type beer, lager type beer, technology of brewing process, equipments used for brewing and distillation, wine and related beverages, distilled spirits.

### **Unit IV (Lectures 12)**

Packaged drinking water- definition, types, manufacturing processes, quality evaluation and raw and processed water, methods of water treatment, BIS quality standards of bottled water; mineral water, natural spring water, flavoured water, carbonated water.

### **References**

1. Hardwick WA. 1995. Handbook of Brewing. Marcel Dekker.
2. Hui YH. et al 2004. Handbook of Food and Beverage Fermentation Technology. Marcel Dekker.

3. Priest FG & Stewart GG. 2006. Handbook of Brewing. 2nd Ed. CRC.
4. Richard P Vine. 1981. Commercial Wine Making - Processing and Controls. AVI Publ.
5. Varnam AH & Sutherland JP. 1994. Beverages: Technology, Chemistry and Microbiology. Chapman & Hall.
6. Woodroof JG & Phillips GF. 1974. Beverages: Carbonated and Non Carbonated. AVI Publ.

### **FTL 6B 15 E3 FOOD TOXICOLOGY (4 CREDITS)**

#### **Unit I** (Lectures 8)

Definition scope and general principles of food toxicology; manifestation of toxic effects; classification of food toxicants; factors affecting toxicity of compounds; methods used in safety evaluation-risk assessments.

#### **Unit II** (Lectures 12)

Toxicants and allergens in foods derived from plants, animals, marine, algae & mushroom; Microbial toxins; Food Poisoning; Food borne infections and disease.

#### **Unit III** (Lectures 8)

Derived Food toxicants- Processing & Packaging; Toxicants generated during food processing such as nitrosamines, acrylamide, benzene, dioxins and furans; persistent organic pollutants.

#### **Unit IV** (Lectures 8)

Toxicology & food additives; Toxicological aspects of nutrient supplements; Chemicals from processing such as fumigants, chlorinated solvents, autoxidation products, carcinogens in smoked foods and pyrolysis, agrochemicals; heavy metals; intentional and unintentional additives.

#### **References**

1. Branen AL, Davidson PM & Salminen S. 1990. Food Additives. Marcel Dekker.
2. Condon JM. 1988. Food Toxicology - Principles & Concepts. Marcel Dekker.
3. Hathcock JN. (Ed.). 1982. Nutritional Toxicology. Vol. I. Academic Press.
4. Rechkig M Jr. 1983. (Ed.). Handbook of Naturally Occurring Food Toxicants. CRC Press.
5. Shabbir S. 2007. Food Borne Diseases. Humana Press.
6. Steven T. 1989. Food Toxicology: A Perspective on Relative Risks.
7. Tweedy BG. 1991. Pesticide Residues and Food Safety. Royal Society of Chemistry.

## GENERAL COURSE: EVALUATION SCHEME

20% weightage shall be given to the internal assessment. The remaining 80% weightage shall be for the external evaluation

### INTERNAL EVALUATION

20% of the total marks in each course are for internal evaluation.

**Table 1: Components of Evaluation**

Sl No	Component	Marks
1	Class room participation based on attendance (20%)	4
2	Test paper(40%)	8
3	Assignment (20%)	4
4	Seminar(20%)	4
	Total	20

**Table 2: Percentage of attendance based on class room participation and Eligible Marks**

% of attendance	Marks
50% -<75%	1
75 % -<85%	2
85% and above	4

**Table 3: Pattern of Internal Question Paper**

Duration	Pattern	Total number of questions	Number of questions to be answered	Marks for each question	Ceiling of Marks
1 Hour	Short answer	6	Up to 6	2	10
	Paragraph	4	Up to 4	5	15
	Essay	2	1	10	1 X10 =10
Total marks					35

**Table 3: Split up of Marks for Test Paper**

Range of marks in Test paper	Internal marks
Less than 35%	1
35%-45%	2
45% - 55%	3
55%-65%	4
65%-85%	6
85%-100%	8

## EXTERNAL EVALUATION

External evaluation carries 80% marks

**Table 1: Pattern of Question Paper**

Duration	Pattern	Total number of questions	Number of questions to be answered	Marks for each question	Ceiling of Marks
2.5 Hours	Short answer	15	Up to 15	2	25
	Paragraph	8	Up to 8	5	35
	Essay	4	2	10	2 X10 =20
Total marks					80

**MODEL QUESTION PAPERS**  
**FTL 1 B 01 PERSPECTIVES OF FOOD SCIENCE & TECHNOLOGY (3 credits)**

**Time 2 Hours**

**Total 60 Marks**

**SECTION A**

Each carry 2 marks (Max.20 Marks)

1. Define Carbohydrates.
2. Name proteins present in Egg.
3. Give two examples for monosacharides.
4. Name any two Anti-Oxidants?
5. Expand IICPT and DFRL.
6. Name any four oil seeds.
7. What are amino-acids? , give examples.
8. Name major spices.
9. Give two probiotics.
10. What do you mean by organic foods?
11. Write the importance of Milk in human nutrition.
12. What are stabilizers?

**SECTION B**

Each Carry 5 marks (Max.30 Marks)



13. Write on composition and nutritive value of Milk.
14. Write a note on health foods.
15. Structure and composition of Rice.
16. Write a short note on preservatives.
17. Write on Carbohydrates and its classification.
18. Discuss in detail about CFTRI and DFRL.
19. Write about sensory analysis of food.

**SECTION C** (1×10 = 10)

20. Discuss in details about health foods.
21. Composition and nutritive value of Meat, Fish and Egg.

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**FTL 2 B 03 FOOD MICROBIOLOGY – I (3 credits)**

**Time 2 Hours**

**Total 60 Marks**

**SECTION A**

Each carry 2 marks (Max.20 Marks)

1. What are the 4 stages of the bacterial growth curve?
2. What is the difference between positive and negative staining?
3. What happens during binary fission in bacteria?
4. Write a note on ascomycetes.
5. Define limits of resolution of a microscope.
6. Write the classification of Virus.
7. Differentiate prokaryotes and eukaryotes.
8. What is pure culture technique?
9. Write a note on bacteriophage.
10. Write the parts of a microscope.
11. Define water activity.
12. Write note on microbes of industrial importance?

**SECTION-B**

Each Carry 5 marks (Max.30 Marks)

13. Differentiate TEM and SEM.
14. Write a note on theory of spontaneous generation.
15. Write the sexual reproduction in bacteria.
16. Briefly explain bacteriophage.
17. Write a note on structure of fungus.
18. Explain bacterial growth curve.
- 19 Write a note on Morphology of Virus.

**SECTION-C(1x10=10)**

20. Explain the structure of bacterial cell with the aid of a neatly labelled diagram, also mention the roles of these structures.
21. Explain electron microscopy.

**FTL 3 B 05 FOOD ENGINEERING (3 Credits)**

**Time 2.0 Hours**

**Total 60 Marks**

**PART A**

Each carry 2 marks (Max.20 Marks)

1. Write the equation for Stephan Boltzmann's law.
2. List the important components of refrigeration system.
3. Briefly explain the types of atomizers used in spray dryers.
4. Differentiate contact and non-contact heat exchangers.
5. Define Apparent Viscosity.
6. Write briefly about fire tube boiler.
7. Differentiate conduction and convection mode of heat transfer.
8. Give plank's equation to estimate freezing time.
9. Briefly describe falling film evaporator.
10. Differentiate pasteurization and sterilization.
11. Give an equation to explain rate of convective heat transfer.
12. Differentiate Newtonian and Non-Newtonian fluids.

**Part B**

Each Carry 5 marks (Max.30 Marks)

13. With the help of a neat sketch explain the working of shell and tube heat exchanger.

14. Explain in detail the vapor compression refrigeration cycle.
15. Explain the working of multiple effect evaporators. What are its advantages over single effect Evaporator.
16. Explain the working of water-tube boiler. How it is different from fire-tube boiler?
17. List the important characteristics that are usually considered in the selection of refrigerant. Explain their importance.
18. What is viscosity? Give SI unit of viscosity. Explain how apparent viscosity is calculated?
19. What is freezing point depression? Explain the working of Air blast freezer.

**Part C** (1x10=10)

20. With the help of a neat sketch describe the working of rising film evaporator. How it is different from falling film evaporator. Give merits and demerits of these evaporators.
21. What are the applications of freezing in food processing? With the help of a neat sketch explain the working of immersion freezer. What are its limitations and advantages?

**FTL 4 B 07 FOOD CHEMISTRY & ANALYTICAL INSTRUMENTATION (4 Credits)**  
**Time 2.5Hours** **Total 80 Marks**

**PART A**

Each carry 2 marks (Max.25 Marks)

1. Name two method of estimating protein in food material
2. What are enzymes?
3. What is enzymatic browning
4. What is the principle of Paper chromatography?
5. What you mean by emulsion?
6. How are proteins classified?
7. Mention different gases used in gas chromatography
8. Write down the principles of TLC
9. State Beer-lamberts law
10. Mention the important part of HPLC
11. What are essential amino acids? Give any two examples.
12. Write the chemical name of Fat?
13. Write two function of Fat?

14. Classify protein.
15. What is gelatinisation of starch?

### **PART B**

Each Carry 5 marks (Max.35 Marks)

16. Kjeldahl's Methods for estimation of Protein
17. Classification of Carbohydrates
18. Hydrogenation
19. Discuss the steps in Thin layer chromatography.
20. Non-Enzymatic browning reaction
21. Write the principle of HPLC
22. Write a note on Column Chromatography
23. Classify fatty acids. Give examples.

### **PART C (2x10 = 20 Marks)**

24. What are enzymes? What are the uses of enzymes in food industry?
25. Explain in detail about the determination of moisture?
26. Discuss briefly about chromatography techniques? How paper chromatography is applicable in food analysis?
27. Explain in detail of working of Atomic Absorption Spectrophotometer?

## **FTL 5 B 09 FOOD MICROBIOLOGY II (3 Credits)**

**Time 2.5 Hours**

**Total 60 Marks**

### **Part A**

Each carry 2 marks (Max.20 Marks)

1. What do you mean by Asepsis?
2. What is food intoxication? Give an example
3. Name any three viruses associated with food poisoning
4. Differentiate between exotoxin and endotoxin.
5. Differentiate yeast and mold
6. Name any two bacteria and two molds involved in spoilage of meat
7. Define coli forms
8. What is serial dilution
9. Physical and agent used for controlling micro-organism.
10. What is TA Spoilage?
11. How does contamination takes place in milk?
12. Mention any two spoilage in meat?

## Part B

Each Carry 5 marks (Max.30 Marks)

13. Explain food poisoning caused by *C. Botulinum*
14. Explain preservation by high temperature
15. What is sauerkraut? Describe the process involved in the production of sauerkraut
16. Differentiate pour plate and streak plate
17. Explain microbiological testing of milk
18. Describe the spoilage caused by thermophilic spore forming bacteria in canned foods?
19. Differentiate selective and differential media.

## Part C

1x10 = 10 Marks

20. What is MPN? Describe the methods involved in testing of water
21. Explain the spoilage in canned food.

**FTL 5 B 10 CEREALS, PULSES & OIL SEEDS & TECHNOLOGY (4 Credits)**  
**Time 2.5 Hours** **Total 80 Marks**

## PART A

Each carry 2 marks (Max.25 Marks)

1. What is floor time?
2. Define rheology?.
3. What is leavening agent?
4. What is Parboiling of rice?
5. Define principles of baking?
6. What is staling of bread?
7. What is anti nutritional factors in Pulses?
8. What is decortication of nuts?
9. Draw the structure of wheat and name the parts?
10. What is tempering of Wheat?
11. Name the different mixing method of cakes?
12. Write the ingredients used in biscuit making.
13. What is toffee?
14. Differentiate between crystalline candy and non crystalline candy?

15. Differentiate between cookies and biscuit?

**PART B**

Each Carry 5 marks (Max.35 Marks)

16. What do you mean by leavening action.
17. What is Gluten? Give its importance.
18. What is parboiling, write its advantages.
19. What do you mean by curing of rice?
20. Write the importance of role of ingredients in bread.
21. Explain toffee manufacturing briefly.
22. What is the impact of ageing of wheat flour? How ageing could be Minimized by using chemicals?
23. Write on TVP

**PART C**

**Answer any two of the following**

**(2x10 = 20 Marks)**

24. Explain the milling of wheat in detail.
25. What is parboiling and differentiate between single boiled and double boiled rice. Write the merits and demerits of Parboiling.
26. Write in detail about various processing steps of bread manufacture.
27. Describe in detail on the processing of oil seeds.

**FTL 5 B 11 FOOD PRESERVATION & PACKAGING TECHNOLOGY (3 Credits)**

**Time 2 Hours**

**Total 60 Marks**

**SECTION-A**

Each carry 2 marks (Max.20 Marks)

1. State the importance of blanching in food preservation
2. Differentiate slow and quick freezing.
3. Expand: 1) HTST 2) UHT
4. Mention any two application of Irradiation in food.
5. Give any one example for artificial preservative and state its function.
6. What is fermentation and give example?
7. What you mean by chilling injury?
8. Principle of microwave heating
9. Write a note on Ultrasonics.
10. Principle of drying
11. What you mean by Hurdle technology.
12. What is the unit of radiation?

**SECTION-B**

Each Carry 5 marks (Max.30 Marks)

13. Give an outline of food irradiation
14. Write a note on ohmic heating
15. Write a note on high pressure technology
16. Explain steps in new product development
17. What do you mean by cryogenic freezing
18. Write a note on freeze drying
19. Differentiate acetic and lactic fermentation

#### SECTION-C

(1X10=10 Marks)

20. Explain the mechanism of spray and drum driers?
21. What are different methods of freezing?

### **FTL 6 B 16 TECHNOLOGY OF ANIMAL FOODS (4 Credits)**

**Time 2.5 Hours**

**Total 80 Marks**

#### **Part A**

Each carry 2 marks (Max.25 Marks)

1. Write on Ageing of meat.
2. Distinguish between penetrative and non penetrative bullets in stunning
3. Comment on Post mortem examination of meat.
4. What is Thermostabilization?
5. Comment on rendering in animal by-product utilization.
6. Explain meat tenderization and the methods.
7. Write on the role of irradiation in meat preservation.
8. What are the egg quality parameters.
9. Describe the different grades of eggs on their size.
10. What are comminute and non comminute meat products.
11. Give a detail on stunning of animals.
12. Differentiate between PSE and DFD meat.
13. Write the function of curing salt in meat.
14. What is the equation for Haugh Unit and write the significance.

15. What is the De-acetylated form of Chitin and its uses?

**Part B**

Each Carry 5 marks (Max.35 Marks)

16. Write on the structure of meat with a detailed sketch.
17. Write a short note on casings used in sausage manufacture.
18. What is fish gelatin? How is it obtained and write the uses.
19. Explain briefly on the production of FPC and its application in food industry.
20. Brief on the slaughterhouse waste utilization.
21. Elaborate on the processing of poultry with the help a flow diagram.
22. Write the chemistry of curing and give detailed description on the ingredients.
23. Write the factors influencing the colour and flavor of meat.

**Part C**

(2×10=20 marks)

24. With the help of a neat sketch describe the lairage in a meat industry.
25. What is Humane method of slaughter and the methods involved. Describe the slaughtering and processing of pig.
26. What is meat emulsion? With the help of a flow chart write the processing of a comminuted meat product and classify it based on the final product availability.
27. Elaborate on the physical, chemical and microbiological spoilage of fish. What are the major products and byproducts of fish industry?

**FTL 6 B 15 E DAIRY TECHNOLOGY( 3 Credits)**

**Time 2Hrs.**

**Total 60 Marks**

**Section A**

Each carry 2 marks (Max.20 Marks)

- 1.What is CIP
- 2.Difference between ice-cream and frozen desert
- 3.Health benefits of probiotics
4. Explain any two quality control tests for milk
- 5.Milk fat percent of light, heavy, and plastic cream
- 6What is standardized milk.
- 7.What is rennet
- 8.Physicochemical properties of cream. Explain any two
- 9.What is yoghurt
- 10.Explain the role of calcium chloride in cheese processing



11. What is acid curd in cottage cheese.
12. What is hardening in ice-cream .

### **Section B**

Each Carry 5 marks (Max.30 Marks)

13. Define Ice-cream? Explain overrun in ice cream.
14. Define the steps in cream processing?
15. What are the factors affecting composition of milk?
16. Differentiate Homogenised and Recombined Milk?
17. What is pasteurization. Explain UHT pasteurization.
18. What is cheese? Classify cheese
19. Define churning. Explain factors influencing churnability of cream?

### **Section C**

(1×10=10)

21. Physico chemical properties of milk
22. Explain the steps in cheese making

## **FTL 6 B 17FOOD SAFETY, FOOD LAWS & REGULATIONS**

**Time 2.5 Hours**

**Total 80 Marks**

### **SECTION-A**

Each carry 2 marks (Max.20 Marks)

1. What do you mean by MAP?
2. Differentiate primary and secondary packaging?
3. Differentiate high risk food and low risk food?
4. Define food adulteration?
5. Name any four sampling tools?
6. What do you mean by CAC?
7. Differentiate disinfectants and Sanitizer?
8. List any four physical hazards?
9. What do you mean by CAP?

10. Name any one adulterant used in milk and its detection method?
11. What do you mean by non-probability sampling.
12. What do you mean by SSOP?
13. What do you mean by FDA?
14. List four important functions of packaging?
15. Write about FAO?

#### **SECTION-B**

Each Carry 5 marks (Max.35 Marks)

16. Write a note on GMP and GHP?
17. Outline the structural requirements of a food plant?
18. Write a note on traceability and recalling?
19. Write a note on common food adulterants and their tests?
20. Explain about the functions and design of glass packaging material?
21. Write about Personal Hygiene for food safety?
22. Differentiate between active and smart packaging with examples.
23. Write short note on ISO:22000

#### **SECTION-C(2X10==20)**

26. Briefly discuss about Food Safety and Standards Act?
27. Briefly discuss the recent trends in packaging?
28. Explain in detail HACCP principles and process in Food Industry
29. Write in detail any food safety management system.

### **FTL 6 B 18 TECHNOLOGY OF FRUITS, VEGETABLES, SPICES & PLANTATION CROPS (4 credits)**

**Time 2.5 Hours**

**Total 80 Marks**

#### **PART A**

Each carry 2 marks (Max.25 Marks)

1. Name the pectin degrading enzymes
2. Write the specification tomato sauce
3. Define maturity index of fruits
4. What is controlled atmospheric storage?
5. Write the types of pickle.
6. Write the types of browning with example
7. What is blanching?
8. What is Cocoa Butter?
9. What is the function of salt in pickling?

10. Differentiate between squash and cordials.
11. What are the factors affecting gel formation
12. How is browning prevented?
13. What are spice oils?
14. What are the changes occurring during ripening?
15. What is the synthesis of jam?

### **PART B**

Each Carry 5 marks (Max.35 Marks)

16. Describe the process preparation of fruit cordial
17. Describe the steps in processing of black Tea.
18. What are pectic enzymes? Discuss their importance in ripening of fruits.
19. What are all the steps in manufacture of oleoresins?
20. Which are the different methods of peeling?
21. Explain manufacture of Chocolate.
22. Differentiate glazed fruit and candied fruit
23. Briefly explain preparation of tomato ketchup. Give the specification.

### **PART C**

**Answer any two of the following**

(2x10 = 20 Marks)

24. What are the steps involved in canning of fruits.
25. Steps involved in manufacture of Jams. Discuss defects in Jam preparation.
26. Give the different steps involved in Cocoa bean processing? Discuss the steps involved in coffee processing.
27. Discuss browning of fruits and vegetables and its prevention.

### **Open course**

**FTL 5 D 01 TECHNOLOGY OF SPICES (3 Credits)**

**Time 2 Hours**

**Total 60 Marks**

### **PART A**

Each carry 2 marks (Max.20 Marks)

1. Name two Aromatic spice.
2. Name two Pungent spice.
3. Chemical used for bleaching Cardamom.
4. Name the alkaloid responsible for biting taste of Pepper.

- 5 King of Spices & queen of spices.
6. Name the major spices of India.
7. What do you mean by “Garbling”?
8. Define Spice.
9. What is the important use of Paprika?
10. Mention the uses of Ginger oils.
11. Mention the important factors that affect quality of Chillies
12. What is function of “Aspirator” in processing Spices?

**PART B**

Each Carry 5 marks (Max.30 Marks)

13. What are Spice oils?
14. How are Spices classified?
15. Briefly explain production of Oleoresin.
16. Explain steps in curing of Turmeric.
17. Explain the processing of cardamom
18. What are the uses of spices?
19. Differentiate between Spices & condiments?

**PART C**

**Answer any one of the following**

**(1x10 =10 Marks).**

20. Explain the different steps involved in processing of Black Pepper.
21. Explain important steps in extraction of Oleoresin.

**FTL 5 D 02 FRUIT AND VEGETABLE PROCESSING (3 Credits)**

**Time 2 Hours**

**Total 60 Marks**

**PART A**

Each carry 2 marks (Max.20 Marks)

1. Name the Tomato based product.
2. Instruments to measure sugar
3. Type of browning reaction in cut surface of Apples.
4. Name a fruit coming under the group Drupe.
5. Name a food additive.

6. What are Non-climatic Fruits ? (Give example)
7. What do you mean by Enzymatic browning ?
8. Write any four changes during ripening of fruits.
9. What do you mean by fermentation? Name a fermented fruit based Product?.
10. Name four mango based products available in market.
11. What do you mean by blanching of vegetables?
12. What are class II preservatives?

#### **PART B**

Each Carry 5 marks (Max.30 Marks)

13. Write the P<sup>H</sup> of low acid and High acid foods.
14. Which are the different methods of peeling.
15. Browning of fruits.
16. Ripening of Fruits.
17. Composition of leafy vegetables.
18. Write briefly processing of pickles
19. Explain briefly different types of storage of fruits & vegetable

#### **PART C**

**Answer any one of the following**

**(1x10 = 10 Marks)**

18. Write a note on classification of fruits. Discuss the general
19. Write a note on pickling. Give the function of ingredients.

### **FTL 5 D 03 FOODS & HEALTH (3 Credits)**

**Time 2 Hours**

**Total 60 Marks**

#### **PART A**

Each carry 2 marks (Max.20 Marks)

1. Define food adulterants.

2. What are Carbohydrates? Give example.
3. What are fat soluble vitamins? Give example.
4. What you mean by BMI?
5. What is Nutrients?
6. What are the major food groups?
7. What you mean by RDA?
8. Write the importance of enzymes.
9. What is preservatives?
10. What is Lactose Intolerants?
11. Name any two food source for protein.
12. Give examples for macro and micro minerals.

**PART B**

Each Carry 5 marks (Max.30 Marks)

13. Briefly explain classification of food.
14. Write a short note on common adulterants found in food.
15. Enlist the food additives and write their importance in food preparation.
16. Write a short note on nutritional composition of food.
17. Write the functions of preservatives with examples.
18. Briefly explain food poisoning. write the symptoms and their control.
19. Write a short note on Types of work and Energy requirements.

**PART C**

(ANSWER ANY 1 QUESTION)

(1X10=10)

20. What is life style diseases? Briefly discuss each of them.
21. Explain briefly about the digestion and absorption of nutrients.

**A014 NUTRITION & HEALTH (4 Credits)**

**Time 2.5 Hours**

**Total 80 Marks**

**PART A**

Each carry 2 marks (Max.25 Marks)

1. Define Health
2. What is mal nutrition?
3. What is under nutrition?

4. What is over nutrition?
5. What is spiritual health?
6. Name the food groups
7. The linkage between two amino acids in a protein
8. What is water balance?
9. What is goitre?
10. Essential Amino acids
11. What is the Energy value of carbohydrate and fats
12. Define Protein Efficiency Ratio.
13. Classify the type of water
14. What is saturated fatty acids and Give one example.
15. Two important factors affecting BMR

#### **PART B**

Each Carry 5 marks (Max.35 Marks)

16. Classify the carbohydrates and give one example to each
17. Specific dynamic action of Food
18. How protein quality will calculate?
19. Role of Iodine in Diet
20. Write the functions of fats
21. Write a short note on BMR?
22. Write a note on dietary fibre
23. Write the digestive enzymes present in Gastro Intestinal Tract.

#### **PART C**

**Answer any two of the following**

**(2x10 = 20 Marks)**

24. How minerals are classified. Explain in detail the role of any two minerals in human nutrition
25. How are fats digested and absorbed in the body .Mention the role of bile juice in fat digestion
26. Explain in detail the role of water soluble vitamins in the human system. Give any four deficiency disease
27. How nutrients are important to human health? Discuss in detail.